Digital Transformation of the Public Sector Using the Example of the Heritage Sector

Inaugural Dissertation for the Award of the
Doctoral Degree in Administrative Sciences
(Doctor Administrationis Rei Publicae)
at the
Faculty of Economics and Social Sciences
of the
University of Bern

submitted by
Beat Estermann
from Hildisrieden (LU) and Rothenburg (LU)

First Supervisor
Prof. Dr. Thomas Myrach
Institute of Information Systems

Second Supervisor
Prof. Dr. Reto Steiner
ZHAW School of Management and Law

Bern, 15 June 2024

Version 1.2 (2 December 2025)

Summary

This cumulative dissertation examines the digital transformation of the public sector using the example of the heritage sector. It gives an empirically grounded account of the transformative processes and presents instruments that facilitate this transformation in practical settings.

At the core of the dissertation is the Open GLAM[1] Benchmark Survey. The data gathered from 1560 heritage institutions in 11 countries show that the observed transformative processes result in increasingly integrated services, participatory approaches, and an emerging collaborative culture. These developments are accompanied by a break-up of proprietary data silos and their replacement with a commonly shared data infrastructure, allowing data to be freely shared, inter-linked and re-used. It argues that some of the transformations observed represent a breakaway from the New Public Management paradigm.

It adapts and applies various instruments for leading change to the heritage sector and argues that the ecosystem metaphor is particularly well suited as an instrument to guide the digital transformation in its current phase. On a methodological level, it makes significant improvements to existing instruments and proposes an analytical framework for digital ecosystem governance. The framework is based on a condensed version of the state of the art from the literature and has been corroborated by data from an empirical case. The dissertation concludes by suggesting that complementary research should be carried out with a focus on the evolution of democracy and political participation, the establishment of trustworthy data spaces, and the widespread use of artificial intelligence.

[1] GLAM stands for "Galleries, Libraries, Archives, and Museums"; the acronym is widely used to refer to the heritage sector as a whole.

Zusammenfassung

Diese kumulative Dissertation untersucht die digitale Transformation des öffentlichen Sektors am Beispiel des Kulturerbe-Sektors. Sie liefert einen empirisch fundierten Beschrieb der Transformationsprozesse und zeigt auf, mit welchen Hilfsmitteln die digitale Transformation in der Praxis vorangebracht werden kann.

Im Zentrum der Dissertation steht der Open GLAM[2] Benchmark Survey. Wie die bei 1560 Kulturerbe-Institutionen in 11 Ländern erhobenen Daten zeigen, führen die beobachteten Transformationsprozesse zu zunehmend integrierten Dienstleistungen, partizipativen Ansätzen und einer Kultur der Zusammenarbeit. Diese Entwicklungen gehen einher mit dem Aufbrechen proprietärer Datensilos zugunsten von gemeinsam genutzten Dateninfrastrukturen, welche eine freie Nutzung, Verknüpfung und Wiederverwendung von Daten ermöglichen. Die Dissertation zeigt auf, dass der beobachtete Wandel in Teilen eine Abkehr vom Paradigma des New Public Management darstellt.

Des Weiteren werden verschiedene Instrumente zur Führung des digitalen Wandels für den Kulturerbe-Sektor adaptiert und angewandt. Es wird aufgezeigt, dass in der aktuellen Phase des digitalen Wandels sich die Ökosystem-Metapher besonders gut als Instrument zur Steuerung des Transformationsprozesses eignet. Durch methodische Anpassungen wurden die bestehenden Instrumente erheblich verbessert. Zudem wurde ein Analyserahmen für die Koordination digitaler Ökosysteme entwickelt. Der Analyserahmen basiert auf einer Synthese des State-of-the-Art und wird durch Erkenntnisse aus einer Fallstudie untermauert. Die Dissertation verortet angesichts des digitalen Wandels weiteren Forschungsbedarf in den folgenden Bereichen: Demokratie und politische Partizipation, Aufbau von vertrauenswürdigen Datenräumen sowie breitflächiger Einsatz von künstlicher Intelligenz.

[2] GLAM steht für "Galleries, Libraries, Archives, and Museums"; das Akronym wird im englischsprachigen Raum allgemein als Synonym für den Kulturerbe-Sektor verwendet. Im deutschsprachigen Raum findet es vor allem im Zusammenhang mit der digitalen Transformation des Kulturerbe-Sektors Verwendung.

Table of Contents

Version Note

Version 1.2 2 December 2025	Contains the manuscript versions of the second and the third journal articles, as the published versions may not be distributed under an open-access-regime.

1 Overview of the Dissertation

1.1 Introduction

New Internet-related practices provide public sector organizations with new opportunities but also create challenges for them. By adopting new technologies, organizations are transforming themselves, the way they operate, and how they interact with their environment (Dunleavy et al., 2006; Dunleavy & Margetts, 2010).

In the early 2010s, one of the largest collaborative communities on the Internet, the Wikipedia/Wikimedia movement, started to systematically reach out to heritage institutions (libraries, archives, museums),[3] to include their content in Wikimedia-related projects, and to benefit from their expertise (Wyatt, 2011; Philips, 2013). Conversely, several pioneer institutions had already managed to harvest the first fruits of the emerging collaborative culture, embracing innovative crowdsourcing approaches and reaching out to online communities (Holley, 2010; Christensen, 2011; Oomen & Aroyo, 2011; Smith-Yoshimura & Schein, 2011). Most institutions, however, were still in an exploratory phase, trying to figure out how they could best adapt to the new circumstances.

These observations gave the impetus to this dissertation: The goal was to reach a better understanding of the transformative processes that were unravelling in the heritage sector and to explore how they fit in with the digital transformation of the public sector in general. In addition, empirically grounded instruments were to be developed that can be used to facilitate this transformation in practical settings.

The dissertation is formally composed of three journal articles (Section 2):

- Estermann, B. (2014). Diffusion of Open Data and Crowdsourcing among Heritage Institutions: Results of a Pilot Survey in Switzerland. *Journal of Theoretical and Applied Electronic Commerce Research, 9*(3), 15–31.

[3] A first large-scale institutional cooperation occurred in 2008, in the form of a partnership between Wikimedia Germany and the German Federal Archives (Wikimedia Commons, 2009). On the international level, the beginning of the institutionalisation of so-called GLAM-Wiki cooperation has been marked by Liam Wyatt's residency as a Wikipedian at the British Museum in 2010 (Wyatt, 2010) and his successive outreach activities in a variety of countries, including Switzerland.

- Estermann, B. (2018). Development Paths Towards Open Government – An Empirical Analysis among Heritage Institutions, *Government Information Quarterly, 35*(4), 599–612.
- Estermann, B. (2025). Leading Public Sector Transformation through an Ecosystem Approach, *Information Polity, 30*(4), 338-357.

In this overview, the research objectives, the methodological approach, and the key results of the research are presented. We conclude the overview with a general appreciation of the research in the light of its objectives and highlight remaining challenges that should be addressed by further research.

1.2 Research Objectives

The overarching objective of this dissertation is to give an empirically grounded account of the transformative processes that occur in the public sector as part of the digital transformation and to develop instruments that facilitate this transformation in practical settings.

To strike a balance between the breadth and the depth of the empirical analysis, the heritage sector was selected as a focus case for the empirical aspects of the research. To account for the co-evolutionary character of different components of the socio-technological systems under observation, some of them external to the heritage sector, the empirical focus was shifted to the thematic area of the performing arts in later phases of the research. See Section 1.3 below for a discussion of the methodological implications of these choices.

The research was carried out by following an iterative process that can be roughly divided into three phases corresponding to the three journal articles. The enquiry was motivated by the author's practice as a change agent and as a researcher in applied sciences fostering the digital transformation of public sector organisations. They were generated by reflecting hands-on practical challenges in the light of the existing academic literature and were designed both to make valuable contributions to the scholarly literature and to yield results that could be applied in practical settings. The research gaps and related research questions were as follows:

1.2.1 Research Questions for Part One (Journal Article 1)

While the advancement of digitization efforts among heritage institutions in Europe had been monitored both at a national and international level (cf. Bakker et al., 2011; Stroeker et al., 2013), the diffusion of other trends, such as open data and crowd-sourcing, had hardly been investigated by the time the first GLAM-Wiki cooperation projects were initiated in Switzerland in 2011. The goal of the first research phase stretching from 2012 to 2013 therefore was to close this gap by tackling the following research questions:

- What are the important trends related to the digital transformation of the heritage sector? What are their driving forces and hindering factors?
- How can these trends be operationalized to allow for empirical analysis?

1.2.2 Research Questions for Part Two (Journal Article 2)

In the second research phase, stretching from 2014 to 2018, the empirical findings from the first phase, which had been derived from a survey among heritage institutions in Switzerland, were to be validated on an international level and to be reflected in the light of the literature on the digital transformation of the public sector in general. The findings were to inform the academic discourse on public sector transformation and to be used to assess the validity and usefulness of instruments used to lead the digital transformation. The main research questions for this phase were thus as follows:

- What are the key characteristics of the digital transformation of the public sector?
- What instruments are generally employed to lead the transformation of the public sector? How are they evaluated in the research literature? To what extent are they empirically valid?

1.2.3 Research Questions for Part Three (Journal Article 3)

And finally, the criticism of the instruments for leading change examined in Phase Two was taken as a starting point to investigate the usefulness of ecosystem models for leading change. Ecosystem models had received increasing attention in the wake of the widespread adoption of open government data policies, as they account for the interdependency of social, technological and information systems. In Phase Three, from

2019 to 2022, the following research questions were thus at the center of our investigation:

- What are the advantages of using an ecosystem approach to lead the transformation of the public sector?
- What aspects ought to be considered when leading the transformation of the public sector by means of an ecosystem approach?

1.3 Methodological Approach

The empirical components of the research primarily focus on the heritage sector. This focus was widened when it comes to examining the ecosystem approach, which is one of the instruments proposed for leading the digital transformation. As it highlights the co-evolutionary character of different system components, it was examined with a focus on the thematic area of the performing arts, involving stakeholders from various sectors. In the following subsection we discuss the motivation of this choice and its methodological implications.

1.3.1 Particularities of the Heritage Sector and the Arts Sector

The cultural heritage sector, which is at the center of the first two parts of the dissertation, is made up of institutions such as museums, libraries, archives and records offices, as well as other organizations with curatorial care of a heritage collection (Nauta et al., 2011). While some heritage institutions are governed by public law, many others are constituted as private nonprofit organizations, a large fraction of which are mainly publicly funded and thus directly affected by public funding policies. The Linked Data Ecosystem for the Performing Arts, which serves as an empirical case for the third part of the dissertation, mainly consists of artists, arts organizations (artist collectives, production companies, arts presenting organizations), research and educational organizations, heritage institutions, as well as a variety of service providers, including providers of data platforms. While some of the organizations involved are governed by public law, others are constituted as private organizations, both for profit and nonprofit. Still, a large proportion of the arts sector's activities is publicly funded and thus directly affected by public funding policies.

While both heritage institutions and arts organizations have received little attention so far in the e-government literature, we expected them to be particularly inclined to embrace the transformations that are the focus of this dissertation, due to several factors (cf. Estermann, 2018): (i) the heritage sector and the arts sector have always been characterized by a certain permeability between the public and the private sectors; cross-sector cooperation between institutions therefore appears quite natural; (ii) some of the organizations concerned have a long-standing history of relying on volunteer work, a form of citizen participation that precedes more recent calls for increased citizen participation through online channels; (iii) there is a strong affinity between the heritage sector and the Wikimedia/Wikipedia community, one of the largest online communities, which makes it easy to seek cooperation around heritage data and content and to engage in online collaboration; the same applies, although to a somewhat lesser extent, to the arts sector and arts data.

1.3.2 Open GLAM Benchmark Survey

At the core of the dissertation is the Open GLAM[4] Benchmark Survey, an international survey designed to capture empirically the key characteristics of the digital transformation of the heritage sector. As shown in Figure 1, it was developed and deployed in two stages, corresponding to Parts One and Two of the dissertation:

The goal of the **Swiss Pilot Survey** was to explore the trends related to the digital transformation of the heritage sector. A first version of the questionnaire was developed based on a literature analysis and interviews with practitioners. To capture the most recent trends and to ensure that the survey instrument would be understood by the target group, the questionnaire was developed in a collaborative manner involving both practitioners and leading domain experts. The online survey was completed in 2012 by 72 out of approximately 200 contacted heritage institutions.

The different Internet-related trends were operationalized in the form of a set of specific questions, and the results of the pilot survey were analyzed and discussed in the

[4] GLAM stands for "Galleries, Libraries, Archives, and Museums"; the acronym is widely used to refer to the heritage sector as a whole.

light of E. M. Rogers' **Innovation Diffusion Theory** (Rogers, 2003). The Swiss Pilot Survey thus laid the methodological foundations for a larger, international survey.

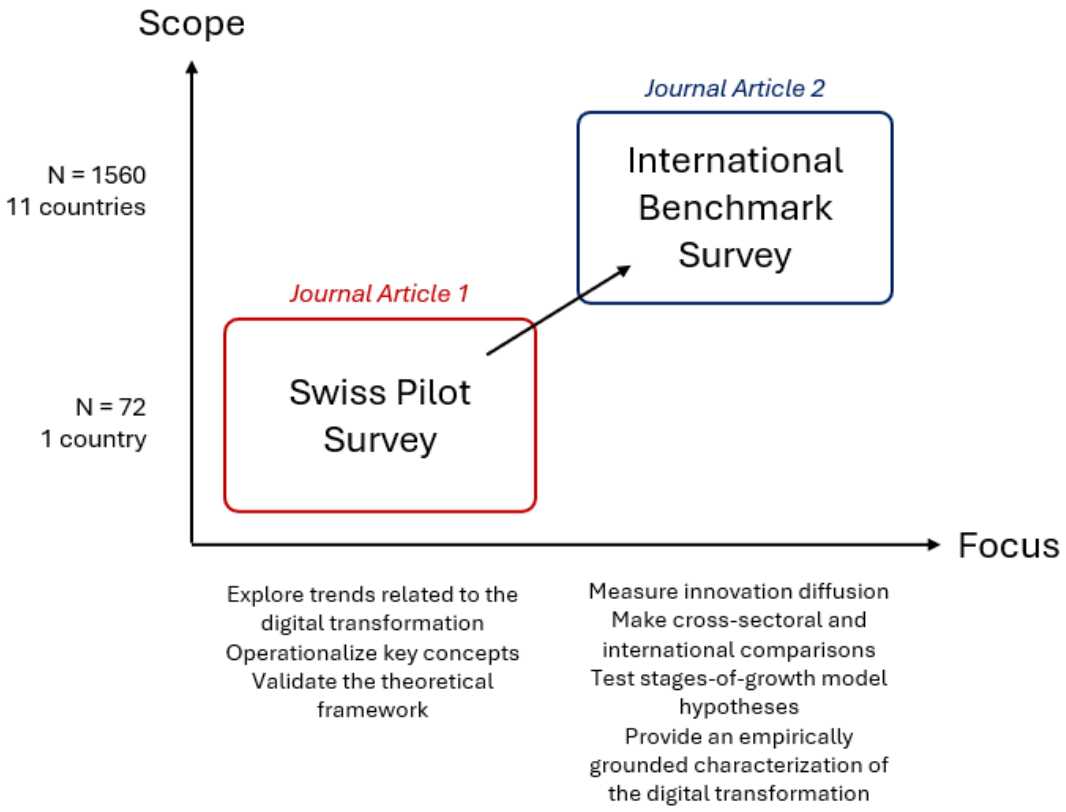


Figure 1: Evolving scope and focus of the Open GLAM Benchmark Survey

Based on the insights gained from the pilot survey, recent publications, and further inputs from the expert community, the questionnaire was updated. This time, the questionnaire was designed to systematically measure innovation diffusion for six Internet-related trends among heritage institutions. To properly capture emergent practices and to account for future developments, the questionnaire included questions about respondents' perspectives on future developments. It was aligned with **Innovation Diffusion Theory** to get an understanding of the dynamics of the changes under observation. Between 2014 and 2016, the **Open GLAM Benchmark Survey** was thus rolled out, gathering data from 1560 heritage institutions in 11 countries.[5]

[5] The questionnaire and the data have been archived on Zenodo: https://zenodo.org/record/7338045

Given its relatively large sample size, this survey allowed for international and cross-sectoral comparisons (cf. Estermann, 2016). Furthermore, it was used to empirically test two **stages-of-growth models** (one of them a so-called **"E-Government Maturity Model"**) related to the "transformation" phase of e-government development and to provide an empirically grounded characterization of the digital transformation occurring in the heritage sector.

1.3.3 Assessing and Developing Instruments for Leading Change

As can be seen in Figure 2, a mix of methods was used to assess and to develop instruments for leading change. The focus is on instruments that are directly related to empirical observations of the transformation at hand.[6]

One of the key challenges thereby is to devise instruments that are empirically grounded and allow for a certain level of prediction and guidance regarding future developments. In the sections which follow, the methods and theoretical models employed are described.

As shown in Figure 2, Parts One and Two of the dissertation focus on trend studies, stages-of-growth models, and benchmarks as instruments for leading change:

Journal Article 1 provides a trend study regarding the digital transformation of the heritage sector. To do so, it draws on a **literature analysis**, **expert interviews**, **online contributions by domain experts**, as well as on an **online survey (Swiss Pilot Survey)**.

[6] There are other instruments for leading change in a digital transformation setting that are more akin to the methods used in design science / design thinking (e.g. hackathons, innovation workshops, etc.). Other instruments, like strategy documents, legal provisions, etc. are more an expression of political will than of empirical findings. Both types of instruments are outside the scope of this dissertation.

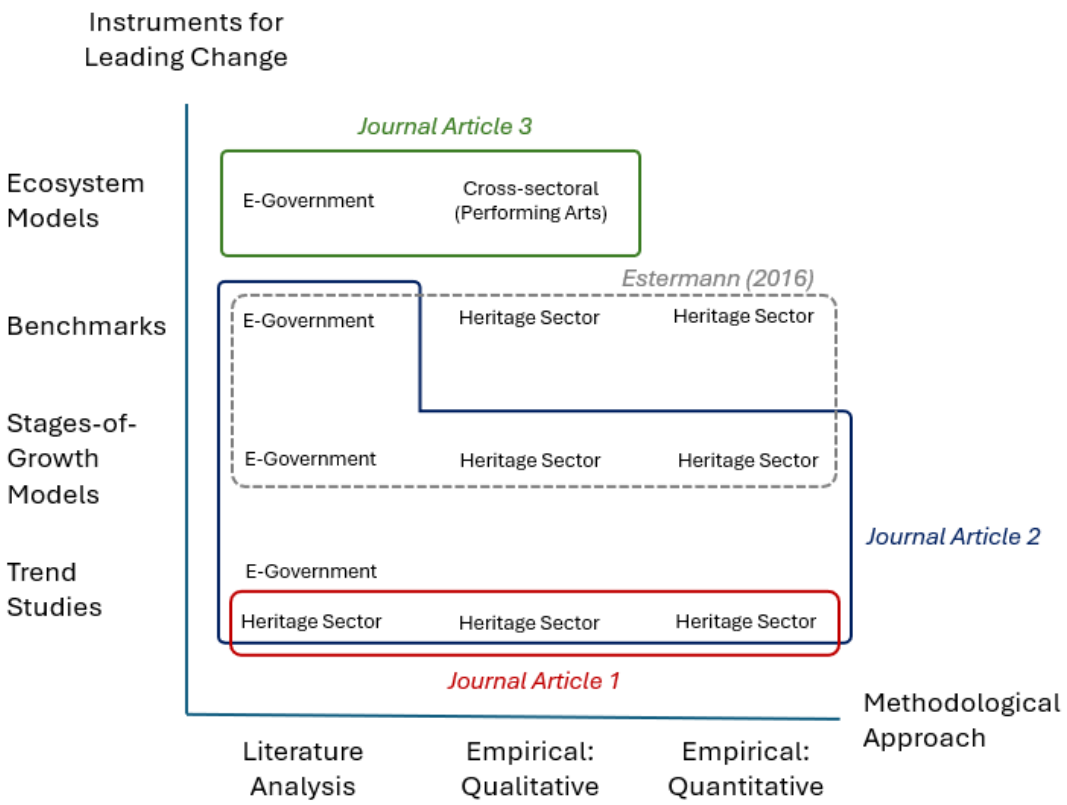


Figure 2: Methods employed to develop and/or assess instruments for leading change

Journal Article 2 contains a critical discussion of stages-of-growth models and benchmarks as they have been used in practice and discussed in the e-government literature since the early 2000s. Furthermore, it analyzes trend studies and stages-of-growth models from the e-government field to describe the expected changes to be observed in the heritage sector. This analysis is corroborated by literature pertaining to the digital transformation of the heritage sector specifically. On this basis, hypotheses as to the type of transformation to be observed are formulated and in turn tested by means of the **Open GLAM Benchmark Survey** (see Section 1.3.2 for a description of the methods employed for its development). The changes observed are discussed in the light of the literature on models of public administration, such as **New Public Management (NPM)**, and contrasted with post-managerial models.[7]

[7] By "post-managerial models of public administration", we mean models and theories that postulate that the digital transformation is giving rise to a new paradigm of public administration, marking a clear departure from the model of New Public Management (NPM), which had been dominant in

For the sake of completeness, Figure 2 also features a paper presented at a Unesco Symposium (Estermann, 2016), which is complementary to Journal Article 2 and focuses on the use of the **Open GLAM Benchmark Survey** for cross-sectoral and international comparisons (benchmarking approach). It discusses the strengths and weaknesses of the approach used in this dissertation compared to other approaches to digitization and open data benchmarking.

Part Three of the dissertation takes the criticism of trend studies, stages-of-growth models, and benchmarks as a starting point to investigate ecosystem models, which constitute another instrument for leading change that has received increasing attention in the wake of the widespread adoption of open government data policies.

Journal Article 3 draws on a **systematic analysis of the literature** on digital ecosystems to provide an **analytical framework** for the analysis and governance of thematic data ecosystems. In doing so, it uses an **extended version of the European Interoperability Framework** (Estermann et al., 2018) as a theoretical lens. To corroborate the findings from the literature and to demonstrate the practical usefulness of the approach, the analytical framework is applied to a concrete case. For this purpose, 17 expert interviews were conducted with members of a network in the process of establishing a linked open data ecosystem for the performing arts (LODEPA) (cf. Estermann & Julien, 2019; Estermann, 2020).

1.3.4 Limitations of the Methodological Approach

As regards the methodological approach, the following limitations apply:

First, we do not pretend to propose a new stages-of-growth model (or an adaptation thereof) for the digital transformation of public administration in general. While the

---

administrative science throughout the 1990s and early 2000s. Some authors have referred to the new paradigm as "Digital Era Governance" (Dunleavy et al., 2006); other terms used in the literature are "collaborative governance" or "adaptive governance". However, given its emergent character, there is no consolidated literature on this new phenomenon yet, and a generally accepted term has yet to emerge within the field of public administration research. In political and activist circles, the term "Open Government" (or "Open GLAM", pertaining to the heritage sector) has been used to refer to roughly the same phenomenon.

proposed model rests on a broad empirical basis and holds for a variety of countries, its validity beyond the heritage sector would need to be established by similar research in the field of classical public administration and in other areas of public sector activity, such as health care, education, or research. Additional research would also be needed to test predictions as to the increased transparency and adoption of participatory approaches in the field of political decision making, made by the authors of some of the first-generation e-government stage models.

Second, while the methods employed have been systematically designed to adequately capture emergent developments, there are limits when it comes to empirically capturing recent trends or even providing empirically grounded predictions of future developments. Thus, it needs to be kept in mind that the insights gathered throughout our research are the product of their time and the given context. In case of doubt, more recent data would need to be gathered.

Third, it has been outside the scope of our research to empirically evaluate the practical usefulness and effectiveness of the instruments for leading change developed as part of this dissertation. To maximize their usefulness and effectiveness, the development of the instruments has been driven by concrete challenges in practical settings and has taken place in close cooperation with the communities of practice concerned. Furthermore, all the instruments presented have been deployed in various practical settings, and anecdotal evidence regarding their usefulness and effectiveness has been used to improve them and to reflect on their conditions of use. However, a proper ex-post evaluation of the effectiveness of their use would have required a different research setting (e.g. a comparative case study covering a longer time period).

1.4 Results

This section provides an overview of the key results of the present dissertation and identifies the main knowledge gaps that have effectively been closed.

1.4.1 Adoption of Internet-related Practices among Heritage Institutions

At the time when the Swiss Pilot Survey and the Open GLAM Benchmark Survey were conducted (2012 and 2014–2016 respectively), the following Internet-related practices were salient among heritage institutions:

Digitization and Increased Cooperation and Coordination among Institutions: As the Internet developed into a widely used medium, heritage institutions started increasingly to digitize their metadata and cultural heritage objects with the goal of making them available online. This digitization effort and associated challenges, such as long-term archiving of digital material or the online presentation of digitized content called for increased cooperation and coordination among heritage institutions (EC, 2001; EC & Salzburg Research, 2002; Manžuch, 2009; Stroeker & Vogels, 2012).

Increased Interactivity and Personalization: With the advent of the so-called "Social Web", the trend towards more interactivity with users and visitors gained momentum among heritage institutions, which launched their own social network presences or started to use new technologies to enhance the possibilities for interaction and personalization for on-site visitors, for example through the use of mobile devices (Christensen, 2011; Capriotti & Pardo Kuklinski, 2012).

Co-production by Users/Visitors (Crowdsourcing): Like other organizations, heritage institutions started to use the Internet to tap into a potentially large volunteer force to further their mission, a phenomenon that has been referred to as "Crowd-sourcing" (Holley, 2010; Oomen & Aroyo, 2011; Smith-Yoshimura & Schein, 2011; Alam & Campbell, 2013; Carletti et al., 2013).

"Free" Licensing and Open Data / Open Content: Some crowdsourcing approaches involve the use of "free" copyright licenses, which allow for the modification and free distribution of copyrighted content. Such licenses play a key role when it comes to re-using media objects from heritage collections (Wyatt, 2011). Various heritage institutions had started to release some of their data and content under "free" licenses in the form of open data / open content (Baltussen et al., 2013).

Linked Data / Semantic Web: Datasets with structured data may be linked to each other to form a so-called "Semantic Web". Unlike the traditional World Wide Web, which has developed as a "web of documents", the Semantic Web forms a "web of data" where data sets and ontologies are interlinked in human- and machine-readable form. Based on this "web of data", new relationships between the objects of the various datasets can be discovered and visualized (Jankowski, 2009; Bauer & Kaltenböck, 2011).

Journal Article 1 gives an overview of these practices and examines the diffusion of open data and crowdsourcing among Swiss heritage institutions in more detail, with a special focus on varying diffusion dynamics as well as driving and hindering factors. The findings suggest that at the time of data collection (2012), only very few institutions had adopted an open data / open content policy. There were however signs that many institutions would soon adopt this innovation since a majority of institutions considered open data as important and believed that the opportunities prevailed over the risks. The main obstacles to be overcome were the institutions' reservations regarding the free licensing of content and their fear of losing control. As to crowdsourcing, the data suggested that the diffusion process would be slower than for open data. Although approximately 10% of the responding institutions had already experimented with crowdsourcing, there was no general breakthrough in sight, as many respondents remained skeptical as to its benefits.

Journal Article 2 gives an empirically grounded account of the diffusion stage for each of the Internet-related practices observed at the time of data collection (2014–2016). It also indicates the typical development paths heritage institutions take when adopting these practices. The unidimensional nature of the Lee & Kwak Open Government Maturity Model (Lee & Kwak, 2012) is rejected. Instead, a more nuanced model is supported by the data, with heritage institutions following several, interconnected paths when implementing Open GLAM related practices.

1.4.2 Towards a New Paradigm of Public Administration

During the early stages of our research, it became apparent that the adoption of new Internet-related practices was driving organizational change among heritage institutions, like elsewhere in the public sector.

Journal Article 2 provides a systematic analysis of the kind of transformations that had been anticipated by successive generations of e-government maturity models and critically assesses the stages-of-growth models that had been proposed in the literature. It shows, based on the empirical findings from the heritage sector, that the transformative processes under observation result in increasingly integrated services, participatory approaches and an emerging collaborative culture. These developments are accompanied by a break-up of proprietary data silos and their replacement by a

commonly shared data infrastructure, allowing data to be freely shared, inter-linked and re-used.

Based on these findings, the article argues that some of the transformations observed represent a breakaway from the New Public Management paradigm that had been dominant in administrative science throughout the 1990s and early 2000s. The new paradigm can be characterized as follows:

- There is an increased focus on the role of networks and on collaborative governance, in contrast to the NPM focus on market exchange. While NPM supported the contracting out of conventional governmental missions to private companies or non-profit organizations, within the new paradigm, public administration draws on citizen engagement to tap into the collective knowledge of the public.
- Government is increasingly taking on the role of a platform, providing free access to data and services for others to exploit as they see fit. This idea of providing infrastructure resources under an open access regime is in stark contrast to the NPM call on governments to monetize their services by charging fees.
- Citizens are increasingly seen as prosumers and collaborators instead of customers as was the case under the NPM agenda. Alongside the increased focus on collaboration between public and private sector organizations, this shift away from the marketization of public services leads to increased permeability of organizational boundaries.
- When it comes to providing infrastructure resources for the digital society, the distribution of roles between the private and the public sectors is reversed: While the NPM model preconized a public sector that looks for best practices within the business sector, the focus on providing data and data-related services as infrastructure resources brings the public sector back into play due to its traditional role in providing key infrastructures and its focus on creating public value.

1.4.3 The Ecosystem Metaphor as a Tool for Leading Change

As trend studies, stages-of-growth models, and benchmarks have proved insufficient for leading the digital transformation described in the previous section effectively, the ecosystem metaphor has increasingly been put forward over the past decade as an instrument which is particularly helpful for leading change in a complex and evolving environment (Harrison et al., 2012; Styrin et al., 2017).

Journal Article 3 systematizes the use of the ecosystem metaphor in analyzing and leading the establishment of thematic data ecosystems. For this purpose, it proposes an analytical framework that is structured along the following dimensions which represent the cornerstones of a data ecosystem: (i) data sharing; (ii) interoperability and shared infrastructures; (iii) stakeholder involvement; and (iv) economic sustainability. Its practical application is demonstrated by the example of the linked open data ecosystem for the performing arts.

1.4.4 Original Contributions to the State of Research

The present dissertation has made significant contributions to the state of research in the following areas:

- It provides a systematic and empirically grounded description of the digital transformation of the heritage sector that has been taking place since the advent of the World Wide Web. It describes in detail the innovative practices that became salient during the 2010s, examines the dynamics of their diffusion in the heritage sector, and proposes an empirically grounded maturity model to be used for leading change in the sector. It thus complements earlier international surveys that focused exclusively on the practice of digitizing heritage material, such as the ENUMERATE survey (Stroeker & Vogels, 2012), as well as the various studies focusing on individual aspects of this digital transformation.
- More generally, it provides an empirically grounded account of the key characteristics of the emergent post-managerial paradigm of public administration based on the example of the heritage sector. It thus makes an original contribution to the theory of public sector transformation by providing a detailed empirical account of the phenomena related to the digital transformation in this specific area. By doing so, it brings the heritage sector to the attention of e-government research, where it has received little attention in the past. This is

of relevance as some of the predicted characteristics of the post-managerial paradigm are likely to manifest themselves in this sector early on.

- It provides an overview and a synthesis of the current state of the art in data ecosystem governance. The synthesis is presented in a condensed format in the form of checklists across four dimensions.

Furthermore, the dissertation has made three significant contributions on a methodological level:

- First, by combining the approach embraced by the e-government stages-of-growth models with E.M. Rogers' Innovation Diffusion Theory, it has overcome some major shortcomings of these models. Most notably, it has demonstrated how the dynamic nature of the transformation processes can be accounted for and how even recent trends can be captured empirically, allowing for a maximum level of predictive power.
- Second, it has demonstrated that the unidimensional nature of first-generation stages-of-growth models does not hold for the transformative stage of e-government development as hypothesized by some authors. It has instead presented a sound method allowing the actual interdependencies and transformation patterns to be revealed based on the empirical observation of specific innovative practices salient in a specific sector at a given time. This approach can easily be adapted to other sectors.
- Third, it has provided an analytical framework that can be used to capture all relevant aspects of data ecosystem governance. In contrast to other governance frameworks, which focus on developing or assessing national or municipal open government data initiatives (cf. Welle Donker & Van Loenen, 2017; Bonina & Eaton, 2020), the proposed analytical framework is geared towards thematic data ecosystems at an international level. The framework can be used out of the box, using the checklists provided. Alternatively, data can be collected from the key stakeholders of a given ecosystem, using the proposed method of data collection and analysis to pinpoint the aspects that are particularly salient in a given data ecosystem at a given time.

1.5 Conclusion and Outlook

As intended, an empirically grounded account of the transformative processes that occur in the public sector as part of the digital transformation has been provided for the example of the heritage sector. The focus on a specific sector has allowed the innovative practices particular to that sector to be investigated. Given the fact that this sector is among the most advanced when it comes to using crowdsourcing, online collaboration, and linked data, these phenomena have been covered particularly well. On the downside, the chosen approach has not allowed the current transformations related to digital democracy, such as new forms of online participation, improved transparency, or the tectonic shifts in the media world, to be captured. Also, the sharing of sensitive personal data among organizations in controlled environments may be more salient in other areas of the public sector.

Several instruments that can be used to facilitate the digital transformation in practical settings have been developed and deployed, again with a specific focus on the heritage sector. The methods employed have been designed in a way to allow them to be easily transposed to other sectors and thematic areas. All the instruments presented have been developed in concrete practical settings with the contribution of leading domain experts and key stakeholders. They have been applied in practice, allowing for the gathering of anecdotal evidence of their use and usefulness and for the formulation of best practice recommendations in view of their use. The methodological setup has however not allowed an empirically grounded ex-post evaluation of the effectiveness and impact of the use of such instruments in practice.

To provide a full picture of the digital transformation of the public sector, complementary research should be carried out with a particular focus on the evolution of democracy and political participation. Further research should focus on the establishment of trustworthy data spaces, allowing for the sharing of sensitive data, as well as on novel practices that have become salient in recent years, such as the widespread use of artificial intelligence. Another challenge that has become more and more salient over recent years, especially in the heritage sector, is how to deal with the colonial legacy. These new developments raise new ethical issues and require adequate public policy measures that go well beyond current guiding principles as enshrined in the Tallinn Declaration on eGovernment (EU, 2017; cf. Marti et al., 2022).

1.6 Bibliography

Alam, S., & Campbell, J. (2013). Dynamic changes in organizational motivations to crowdsourcing for GLAMs. *Proceedings of the Thirty Fourth International Conference on Information Systems, Milan*, pp. 1–17.

Bakker, S, de Niet, M., & Nauta, G. J. (2011). Overview of national and international initiatives. *Egmus*. http://www.egmus.eu/fileadmin/ENUMERATE/deliverables/ENUMERATE-D2-01.pdf, Accessed on 30 July 2015.

Baltussen, L. B., Brinkerink, M., Zeinstra, M., Oomen, J., & Timmermans, N. (2013). Open culture data: Opening GLAM data bottom-up. *MW2013: Museums and The Web, Portland OR, USA, April 17–20, 2013*.

Bauer, F. & Kaltenböck, M. (2011). *Linked Open Data: The Essentials: A Quick Start Guide for Decision Makers*. Austria: SEMANTIC-WEB COMPANY.

Bonina, C., & Eaton, B. (2020). Cultivating open government data platform ecosystems through governance: Lessons from Buenos Aires, Mexico City and Montevideo. *Government Information Quarterly*, *37*(3).

Carletti, L., Giannachi, G., Price, D., & McAuley D. (2013). Digital humanities and crowdsourcing: An exploration. *MW2013: Museums and The Web, Portland OR, USA, April 17–20, 2013*.

Capriotti, P., & Pardo Kuklinski, H. (2012). Assessing dialogic communication through the internet in Spanish museums. *Public Relations Review*, *38*(4), 619–626.

Christensen, J. R. (2011). Four steps in the history of museum technologies and visitors' digital participation. MedieKultur. *Journal of Media and Communication Research*, *27*(50), 7–29.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). *Digital era governance: IT corporations, the state, and e-government*. Oxford University Press.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New public management is dead—Long live digital-era governance. *Journal of Public Administration Research and Theory*, *16*(3), 467–494.

Dunleavy, P., & Margetts, H. (2010). The second wave of digital era governance. *American Political Science Association Conference, 4 September 2010, Washington DC, USA*. http://eprints.lse.ac.uk/27684/

Estermann, B. (2014). Diffusion of Open Data and Crowdsourcing among Heritage Institutions: Results of a Pilot Survey in Switzerland. *Journal of Theoretical and Applied Electronic Commerce Research*, *9*(3), 15–31.

Estermann, B. (2016). OpenGLAM Benchmark Survey – Measuring the Advancement of Open Data/Open Content in the Heritage Sector. *Proceedings of the International Symposium on the Measurement of Digital Cultural Products, 9–11 May 2016, Montreal, Canada*.

Estermann, B. (2018). Development Paths Towards Open Government – An Empirical Analysis Among Heritage Institutions, *Government Information Quarterly*, *35*(4), 599–612.

Estermann, B. (2020). Creating a Linked Open Data Ecosystem for the Performing Arts (LODEPA). *Arti dello Spettacolo / Performing Arts*, Year 6, Special Issue, pp. 31–49.

Estermann, B. (submitted). Leading Public Sector Transformation through an Ecosystem Approach. Manuscript submitted to Information Polity on 10 March 2024.

Estermann, B., Fraefel, M., Neuroni, A., & Vogel, J. (2018): Conceptualizing a National Data Infrastructure for Switzerland. *Information Polity, 23*(1), 43–65.

Estermann B., & Julien, F. (2019). *A Linked Digital Future for the Performing Arts: Leveraging Synergies along the Value Chain*. Canadian Arts Presenting Association (CAPACOA) in cooperation with the Bern University of Applied Sciences.

European Union (EU) (2017). *Tallinn Declaration on eGovernment*. Tallinn, 6 October 2017.

Harrison, T. M., Pardo, T. A., & Cook, M. (2012). Creating open government ecosystems: A research and development agenda. *Future Internet*, *4*(4), 900–928.

Holley, R. (2010). Crowdsourcing: how and why should libraries do it? *D-Lib Magazine*, *16*(3/4).

Jankowski, J, Cobos, Y., Hausenblas, M., & Decker, S. (2009). Accessing cultural heritage using the web of data. *Proceedings of the 10th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST, Malta, 2009*.

Lee, G., & Kwak, Y. H. (2012). An open government maturity model for social media based public engagement. *Government Information Quarterly*, *29*(4), 492–503.

Manžuch, Z. (2009). Monitoring digitisation: lessons from previous experiences. *Journal of Documentation*, *65*(5), 768–796.

Marti M., Estermann, B., & Neuroni, A. (2022). Die Tallinn-Prinzipien als Wegbereiter der digitalen Transformation des öffentlichen Sektors in der Schweiz. In: Mertes, A., & Pleger L. E. (ed.) (2022). *Digitale Transformation der öffentlichen Verwaltung in der Schweiz*. Wiesbaden: Springer Gabler, 299–322.

Nauta, G. J., Bakker, S., & de Niet, M. (2011, November). ENUMERATE Core Survey 1 Methodology. *Egmus*. http://www.egmus.eu/fileadmin/ENUMERATE/deliverables/ENUMERATE-D2-04.pdf, Accessed on: 30 July 2015.

Oomen, J., & Aroyo, L. (2011). Crowdsourcing in the cultural heritage domain: Opportunities and challenges. *Proceedings of the 5th International Conference on Communities & Technologies – C&T 2011, Brisbane, Australia*, pp. 138–149.

Phillips, L. B. (2013). The temple and the bazaar: Wikipedia as a platform for open authority in museums. *Curator: The Museum Journal*, *56(2)*, 219–235.

Rogers, E. M. (2003). *Diffusion of Innovations*. New York: Free Press.

Smith-Yoshimura, K., & Schein, C. (2011). *Social Metadata for Libraries, Archives and Museums Part 1: Site Reviews*. Dublin, Ohio: OCLC Research.

Stroeker, N. & Vogels, R. (2012, May). Survey report on digitisation in European cultural heritage institutions 2012. *ENUMERATE*. http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Digitisation-Survey-2012.pdf, Accessed on: 12 June 2023.

Stroeker, N., Vogels, R, Nauta, G. J., & de Niet, M. (2013) Report on the enumerate thematic surveys on digital collections in European cultural heritage institutions. *ENUMERATE*.

http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Thematic-Survey-2013.pdf, Accessed on: 12 June 2023.

Styrin, E., Luna-Reyes, L. F., & Harrison, T. M. (2017). Open data ecosystems: an international comparison. *Transforming Government: People, Process and Policy*, *11*(1), 132–156.

Welle Donker, F., & van Loenen, B. (2017). How to assess the success of the open data ecosystem? *International Journal of Digital Earth*, *10*(3), 284–306.

Wikimedia Commons (2009). Commons: Bundesarchiv, Revision as of 15 November 2009. *Wikipedia Commons*. Permalink: https://commons.wikimedia.org/w/index.php?title=Commons:Bundesarchiv/de&oldid=31931776

Wyatt, L. (aka wittylama) (2010). The British Museum and Me. *Witty's Blog*, 13 March 2010. https://wittylama.com/2010/03/13/the-british-museum-and-me/ Accessed on: 13.06.2024.

Wyatt, L. (2011). Wikipedia & Museums: Community Curation. *Uncommon Culture*, *2*(1), 33–41.

2 Journal Articles Forming Part of the Dissertation

2.1 Diffusion of Open Data and Crowdsourcing among Heritage Institutions: Results of a Pilot Survey in Switzerland

Paper published in the Journal of Theoretical and Applied Electronic Commerce Research

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

Diffusion of Open Data and Crowdsourcing among Heritage Institutions: Results of a Pilot Survey in Switzerland

Beat Estermann[1]

[1] Bern University of Applied Sciences, E-Government Institute, Bern, Switzerland, beat.estermann@bfh.ch

Received 30 July 2013; received in revised form 13 February 2014; accepted 28 February 2014

Abstract

In a pilot survey we examined the diffusion of open data and crowdsourcing practices among heritage institutions in Switzerland. The results suggest that so far, only very few institutions have adopted an open data / open content policy. There are however signs that many institutions may adopt this innovation in a near future: A majority of institutions considers open data as important and believes that the opportunities prevail over the risks. The main obstacles that need to be overcome are the institutions' reservations with regard to *free* licensing and their fear of losing control. With regard to crowdsourcing the data suggest that the diffusion process will be slower than for open data. Although approximately 10% of the responding institutions already seem to experiment with crowdsourcing, there is no general breakthrough in sight, as a majority of respondents remain skeptical with regard to the benefits. We argue that the observed difference in the dynamics of the diffusion of these innovations is primarily due to the fact that crowdsourcing is perceived by heritage institutions as more complex than open data, that it isn't readily expected to lead to any sizeable advantages, and that adopting crowdsourcing practices may require deeper cultural changes.

Keywords: Heritage institutions, Open data, Open content, Crowdsourcing, Diffusion of innovations

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

1 Introduction

In recent years, more and more heritage institutions are making their data and content available under free copyright licenses, so that they can be re-used, modified and distributed by anybody for any purpose at no cost. In fact, open data holds many promises for the heritage sector when it comes to connecting datasets of various institutions and encouraging the creation of new value-added services or new artistic creations. Heritage institutions also increasingly engage in crowdsourcing practices and online collaborative projects, such as Wikipedia, which allow them to involve their audiences in novel ways, to enhance their metadata and content, and to make cultural objects available in new contexts.

Since the advent of the World Wide Web the cultural heritage sector has undergone important changes that have taken the form of a series of successive and sometimes overlapping trends: Since the early 2000s widespread digitization of heritage objects and their metadata has been pursued as a strategic goal (as exemplified in Europe by the Lund Action Plan for Digitization [16], [17]). Digitization in turn spurred increased cooperation and coordination among heritage institutions in order to set up common catalogues with a single-point-of-access, to create virtual libraries, or to coordinate digitization efforts and long-term archiving [18], [24]. Thus, digitization not only assists preservation of cultural heritage, but has turned out to be a powerful means to expand access to collections for wider audiences [24], [26]. Half a decade later, heritage institutions started to embrace the use of web 2.0 tools, such as Facebook or Twitter, to get their messages out to their publics, and to engage them in conversations. In some cases, the users/visitors are even integrated in the *production process*, thus becoming *prosumers*. Over the last few years, crowdsourcing and collaborative content creation have spread thanks to projects like Wikipedia or Flickr Commons. Some heritage institutions cooperate with existing online communities; others have launched their own crowdsourcing projects [9], [26], [27]. Another, rather recent trend concerns the use of *free* copyright licenses and the adoption of open data policies in order to make data available in a structured, machine-readable format – *free* for anyone to be re-used, modified, integrated with other content, and re-published. Thanks to linked open data, datasets from various publishers can be integrated based on commonly shared ontologies [22].

While the advancement of digitization efforts among heritage institutions in Europe is being monitored both at a national and international level (see [3] or [32]), the diffusion of other trends, such as open data and crowdsourcing, have hardly been investigated yet. In order to bridge that gap, a pilot survey among heritage institutions in Switzerland was carried out [15]. The purpose was to create an instrument that allows measuring the level of adoption of open data policies and crowdsourcing practices among heritage institutions in order to inform the main stakeholders about the developments in this area and to get an overview of the main challenges and driving forces. In this article we first provide an overview of previous research regarding the adoption of open data and crowdsourcing by heritage institutions. We then present key findings from the Swiss pilot survey, relating them to earlier research and discussing them in the light of innovation diffusion theory, and conclude the article with a series of suggestions in view of further research.

2 Definition of Core Concepts

In the following, we shall shortly introduce the core concepts referred to in this article, such as open data, linked open data and crowdsourcing, as well as the theory of innovation diffusion that serves as our primary theoretical lens.

2.1 Open Data

The open data movement, which had taken its origin in academic circles more than 50 years ago, experienced its worldwide breakthrough some five years ago when the Obama Administration and the UK Government adopted *Open Government Data* policies in order to promote transparency, participation, and collaboration between politicians, public authorities, private enterprises, and citizens. The term *data* includes all kinds of data: study reports, maps, satellite photographs, pictures and paintings, weather data, geographical and environmental data, survey data, the genome, medical data, or scientific formulas [7]. Open data has been hailed for its innovative capacity and transformative power [36].

According to the Sunlight Foundation's ten *Open Data Principles* [33] which serve the open data movement as a reference, data are considered as *open* if they can be re-used, modified and distributed by anybody for any purpose at no cost. In order to facilitate re-use, the data need to be made available in a machine readable format, i.e. as structured data. Typically, open data or content that is subject to copyright protection is made available under a *free* copyright license, which allows users to freely modify and to re-distribute a work.

2.2 Linked Open Data

While the call to open up public sector information can be seen as a logical extension of the freedom of information regulations that have been adopted by many countries since the 1990's, the open data movement is also driven by a

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

technical and economical vision: a *semantic web* is to be created by linking many *open* datasets from various sources. Thus, *linked open data* will serve as an infrastructure resource for third parties to build value-added services on top of it, such as new combinations of data, visualizations, or other data-driven services [5], [22].

2.3 Crowdsourcing

The term *crowdsourcing* was coined by Jeff Howe in 2006 in Wired Magazine, combining the two terms *crowd* and *outsourcing*: *"*Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers*"* [21]. The term has since been used with somewhat varying definitions; Estellés-Arolas and González-Ladrón-de-Guevara have compared forty original definitions of crowdsourcing in order to propose a comprehensive definition: "Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task" [14]. p. 9.

2.4 Innovation Diffusion

For more than half a century, scholars in various fields have studied how and under which conditions innovations spread through social systems. According to Everett M. Rogers, who has popularized the *innovation diffusion* approach, "an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" [28]. p. 36. The diffusion of an innovation is a social process that unfolds as the members of a social system get acquainted with an innovation and go through the innovation decision process. Thereby, "an individual (or other decision-making unit) passes from first knowledge of an innovation, to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision" [28]. p. 20.

3 Previous Research

This section contains an overview of previous research regarding the adoption of open data and crowdsourcing by heritage institutions, followed by a discussion of how open data and crowdsourcing relate to each other and an outline of the key elements of innovation diffusion theory that will be referred to later on in the article.

3.1 Open Data in the Cultural Heritage Domain

Research regarding the adoption of open data practices among heritage institutions is still relatively scarce. Baltussen et al. [4] describe the approach several organizations had been pursuing since 2011 in the Netherlands in order to create an open data ecosystem in the cultural heritage sector. Based on two expert workshops with cultural institutions they identified the main benefits and risks of opening up cultural data. They found that the number one concern among cultural heritage professionals was that opening up collections would result in material being spread and reused without proper attribution to the institution. Related to this was a perceived loss of control over the collections. Concerning financial aspects, the workshop participants did not fear a direct loss of income by making data openly available, but were afraid that they may fail to generate extra income in the future as third parties develop new business models based on their datasets. Related to the perceived loss of attribution and control was also a perceived loss of brand value. Finally, concerns regarding privacy violations were an issue for organizations that hold data containing personal information. Overall, the workshop participants agreed that open data should be part of an institution's public mission, especially if it received public funding. In their view, making collections widely accessible was at the heart of the majority of cultural heritage institutions. Furthermore, the cultural heritage professionals expected to be able to enrich data through aggregators like Europeana or other parties and to link their open data to that of other, related collections. Being able to increase the amount of channels by which end users can be reached was also seen as an important benefit of open data. As a consequence, the workshop participants also expected benefits in terms of better discoverability, which drives users to the provider's website. Further perceived benefits were increased relevance of institutions and the possibility of attracting and interacting with new customers.

These findings partly reflect earlier findings by Eschenfelder and Caswell [13] who surveyed 234 *innovative* cultural heritage institutions in the United States in order to tackle the question in which cases cultural institutions ought to control reuse of digital cultural materials. The main motives mentioned by archives, museums, and libraries for controlling the access to their collections were: (i) avoiding misuse or misrepresentation, (ii) ensuring proper object description and repository identification, (iii) avoiding legal risk, as well as (iv) donor or owner requirements. Among the top five reasons why they would limit the access to their collections, archives also mentioned generating income, libraries the impossibility to obtain the necessary rights, and museums their unwillingness to give up control over information about endangered or valuable objects, animals, or cultural events/items. The main motives against controlling the access, and thus in favor of opening up their collections, were (i) the belief that open collections have

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

greater impact, (ii) concerns about legal complexity when access had to be regulated for various user groups, and (iii) the institutional mission, policies or statutory requirements.

Some of the legal concerns are likely to be absent in the case of public domain works. Kelly [23] examined the policies on image rights at eleven art museums in the United States and the United Kingdom, when the underlying works are in the public domain. Investigating how and why the museums had arrived at their approach and what key changes resulted from the policy, she found that providing open access was a mission-driven decision, but that different museums looked at open access in different ways. For some it was primarily a philosophical decision, while for others it was also a business decision. For most museums, developing and adopting an open access policy was an iterative and collaborative process, with many stakeholders working together to come up with an appropriate approach. Staff at many museums cited the following critical factors that favored the adoption of an open access policy: diminishing revenues, difficulties when it came to drawing a line between scholarly and commercial uses of their images, senior management support for an open access policy, as well as technical innovations that enabled images to be made accessible with greater ease. In the process, they had to overcome a series of concerns, such as fears regarding the consequences of loss of control, challenges regarding metadata quality, technical challenges when it came to providing access to the collections through the museum's website, as well as a possible loss of revenue. Most museums reported positive outcomes of opening up their collections. Staff mentioned the goodwill and recognition that came with open access, as well as a sense of satisfaction at helping to fulfil the institution's mission. Virtually all museums experienced increased website traffic, and in some cases, curators received better and more interesting inquiries from scholars and the public. There were also positive side effects in that the policy change forced the institutions to think through their policies and their implications, as well as in form of improved technology skills among the staff members. Some museums mentioned downsides of the open access approach: For museums without automated delivery systems, increasing numbers of image requests had led to an increase in workload. Thus, an increased demand may result in a need for investments in the technical infrastructure. Unsurprisingly, most museums in the survey reported stable or lower revenue from rights and reproductions. And finally, some museum staff mentioned that it had become more difficult to track the use of images or objects in their collections.

It has to be noted that many of the cases cited by Kelly [23] relate to museums that did not comply with the Sunlight Foundation's *Open Data Principles*, but pursued open access approaches that were limited to educational or scholarly use only, even for works that were in the public domain. In the case of US institutions claiming copyright over faithful reproductions of two-dimensional works, such approaches most likely amount to copyright overreaching [10]. Copyright overreaching occurs when claims of copyright protection are made that overreach the bounds of justifiable legal rights. Examining policies from U.S. museums, Crews [10] found four varieties of copyright overreaching: assertions of false copyrights; claims to copyrights not held by the museum; assertion of control beyond rights of copyright; and claims of quasi-moral rights. He identified four motivations for copyright overreaching: protecting the integrity of art, generating additional revenue, getting credit for the museum's collections and other good work, as well as adherence to donor requirements.

3.2 Crowdsourcing in the Cultural Heritage Domain

There are plenty of examples of crowdsourcing approaches in the cultural heritage sector. Several authors have created inventories of crowdsourcing projects throughout the world [8], [20], [25]-[26], [30], [34]. Based on these inventories, typologies have been developed: Oomen and Aroyo [26] propose a classification scheme based on the digital content life cycle model of the National Library of New Zealand, distinguishing the following types of crowdsourcing approaches: correction, classification, contextualisation, co-curation, complementing collections, and crowdfunding. They also point to the fact that crowdsourcing initiatives in the cultural heritage domain may be executed without institutions being in the lead. They expect that more and more crossovers will take place between community- and organization-driven projects, as is the case with co-operations between heritage institutions and the Wikipedia community. This observation matches the insights gathered by Terras [34] who investigated amateur online museums, archives, and collections and concluded that the best examples of these endeavors can teach best practice to traditional heritage institutions in how to make their collections useful and to engage a broader user community. She not only recommends that heritage institutions increasingly use web 2.0 services such as Flickr, Twitter, and Facebook to build an online audience, but also encourages them to bridge the gap between pro-amateurs with their private collections of ephemera, and institutional collections.

Smith-Yoshimura and Schein [30], investigating social metadata approaches, developed a typology of crowdsourcing approaches that is slightly different from the one proposed by Oomen and Aroyo [26], and applied it to a sample of 24 websites from the cultural heritage domain which engage their communities and seek user contributions by providing social media features, such as tagging, comments, reviews, images, videos, ratings, recommendations, lists, or links to related articles. They found that within their sample of 24 websites, 16 used crowdsourcing for data enhancement in the form of improving description, 11 for collection and content building, and 10 for data enhancement in the form of improving subject access. Further areas of crowdsourcing were: ratings and reviews (i.e. for collecting subjective opinions), promoting activities outside of the site, sharing and facilitating research, as well as networking and community building.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

In addition to social media functionalities built into institutions' websites, Smith-Yoshimura and Schein also investigated the use heritage institutions make of third party social media sites, such as LibraryThing, Flickr, Youtube, Facebook, Wikipedia, and blogs. Based on comparative case descriptions, they reached the following conclusion:

"LibraryThing is an excellent resource from which to harvest user-generated metadata on published works and disseminate information on one's own holdings of published materials, but impractical for unique or unpublished works. Flickr is an unparalleled vehicle for sharing still images and gathering user-generated description of the images. YouTube is the leading site for promoting and sharing moving images. Facebook provides an avenue through which LAMs [i.e. Libaries, Archives, and Museums] can communicate textually and imbed audio, video, and images. Twitter is an efficient way to push out short textual messages, such as announcements and alerts. Wikipedia offers the potential to reach a broad audience and direct web traffic to a LAM and its select resources. Blogs, especially those built in-house, are perhaps the most adaptable platform for communicating various formats of information through an interface that can be functionally and visually tailored to suit institutional needs. Establishing a presence on social networking sites, wikis and blogs enables LAMs to bring their resources to online environments where users are already active, exposing content to new audiences, encouraging user interaction, and fostering a sense of community" [30]. p. 64.

Regarding the numbers of heritage institutions using third party social media sites, they report that 1600 libraries worldwide used LibraryThing to harvest user-generated content and to enhance the descriptions of published works in their online public access catalogues. For the other types of social media services, they report findings from a survey carried out among special collections and archives in academic and research libraries in the United States and Canada [11]. According to that study, 49% of the 169 responding institutions indicated that they were using institutional blogs, 39% had a social networking presence, 37% reported adding links to Wikipedia, 30% used Flickr, roughly one quarter used Twitter (25%), YouTube (24%) or Podcasting (24%), 17% had an institutional wiki, 15% collected user-contributed feedback (e.g. through social tagging), and 10% used mobile applications to reach out to their audiences. Responding institutions were also asked which of these services they were planning to implement within a year. Here, institutional blogs rated highest with 19%, followed by user-contributed feedback (16%). Regarding the publication of heritage content on Wikipedia, the first core survey of the ENUMERATE project revealed that among the 774 responding European heritage institutions, on average 3% of their digital collections is accessible through Wikipedia [31].

Holley [20] insists on the difference between social engagement (e.g. social tagging) and crowdsourcing, arguing that crowdsourcing usually entails a greater level of effort, time and intellectual input from an individual. According to her, crowdsourcing relies on sustained input from a group of people working towards a common goal, whereas social engagement may be transitory, sporadic or done just once. As a consequence, setting up a crowdsourcing project is about "using social engagement techniques to help a group of people achieve a shared, usually significant, and large goal by working collaboratively together as a group" [20]. She argues that libraries are already proficient in social engagement with individuals, as many forms of social engagement in libraries pre-date the advent of the Internet, but that they are not necessarily proficient yet at defining and working towards group goals. Oomen and Aroyo [26] point to motivating users for participation and supporting quality contributions as major challenges of crowdsourcing.

There is hardly any research into heritage institutions' motivations for crowdsourcing. In an attempt to fill that gap, Alam and Campbell [1] carried out a case study to investigate organizational motivations for crowdsourcing by the National Library of Australia. They found that the institution was motivated by a set of attributes that dynamically changed throughout the implementation of the crowdsourcing project, ranging from resource constraints to utilizing external expertise through to social engagement. The researchers noted that the project resulted in a high level of social engagement, active collaborations with and between stakeholders, and development of *bridging* social capital that in turn instigated further motivations for the organization. They concluded that this dynamic change of organizational motivation may well be crucial for the long-term establishment of crowdsourcing practices.

3.3 How do Open Data and Crowdsourcing Relate to each Other?

The link between heritage institutions' adoption of open data policies and their engagement in crowdsourcing approaches hasn't been studied explicitly yet; there are however several indications that these practices may converge: Flickr Commons, for example, requires that the images made available by heritage institutions be either in the public domain or *have "*no known copyright restrictions*"* [30]. At the same time, it invites its users to help describe the photographs they discover on Flickr Commons, either by adding tags or leaving comments [34]. Similarly, the Wikipedia/Wikimedia community requires that content provided to its projects be made available under a *free* copyright license, which allows third parties to share, modify, and re-distribute the content [35].

This convergence of open data policies and crowdsourcing approaches is fully in line with Alam's and Campbell's observation of a shift from egoistic motives towards a more public value focus as heritage institutions engage in true collaboration with their crowdsourcing communities [1]. It is also reminiscent of Wyatt's remark that Wikipedia should not be described as a product of user-generated content, *sitting alongside blogging, social-networking and video sharing websites*, but that it is far better understood as a place of community curated works, "where the individual Wikipedian is not merely a *user* of a corporation's infrastructure but also potentially the author, reader, reviewer and maintainer of every aspect of the project content, code and community" [35]. Cooperating with the

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

Wikimedia/Wikipedia community thus requires heritage institutions to subscribe to the community's public value orientation, which calls for a release of data and content under *free* copyright licenses.

The convergence of user participation, inter-organizational cooperation, and open data is also reflected in Oomen and Aroyo's vision of a "more open, connected and smart cultural heritage: open (the data is open, shared and accessible), connected (the use of linked data allows for interoperable infrastructures, with users and providers getting more and more connected), and smart (the use of knowledge and web technologies allows us to provide interesting data to the right users, in the right context, anytime, anywhere – both with involved users/consumers and providers)" [26].

3.4 Diffusion of Innovations

In our study we use the *innovation diffusion* approach as a theoretical lens to study where heritage institutions stand with regard to the adoption of open data policies and the engagement in crowdsourcing approaches. As Rogers [28] notes, the diffusion approach is particularly well suited to connect research and practice. Thanks to a wide application of the approach in various fields, many insights into the innovation diffusion process as such have been gathered that can be applied to inform stakeholders in new areas of innovation. In the following, we will shortly outline the elements of innovation diffusion theory we draw upon in this paper.

Decision stages: the innovation adoption process has been widely described as comprising different, successive stages, although the number of stages, their precise definition, and their naming varies according to the authors. The stage model developed by Beal and Bohlen [6] comprises five distinct stages of innovation adoption: awareness stage, interest stage, evaluation stage, trial stage, and adoption: At the *awareness stage*, agents become aware of some new idea, but lack details concerning it. At the *interest stage*, they are seeking more information about the idea, and at the *evaluation stage*, they make a mental trial of the idea by applying the information obtained in the previous stage on their own situation. At the *trial stage*, they apply the idea in a small-scale experimental setting, and if they decide afterwards in favor of a large-scale or continuous implementation of the idea, they have reached the *adoption stage*. The stage model was originally developed in order to understand the innovation adoption process of individuals. When applied to organizations, it has to be kept in mind that individual organizations may not pass through the stages in a linear fashion, but may move back and forth between stages in a process that is characterized by shocks, setbacks, and surprises [19]. In practice, a differentiation of decision stages can be useful to choose the appropriate communication channel to promote an innovative practice. As Rogers [28] notes, mass communication channels are relatively more important at the awareness stage, while interpersonal channels are relatively more important at later stages in the innovation-decision process.

Adopter categories: Rogers uses adopter categories to classify the members of a social system on the basis of innovativeness. Different adopter types assimilate an innovation at different moments of the innovation-diffusion process. Five adopter categories are distinguished: (i) innovators, (ii) early adopters, (iii) early majority, (iv) late majority, and (v) laggards. These categories represent *ideal types* that were created for analytical purposes. While investigations regarding the characteristics of different adopter categories and their role in the innovation process have led to many valuable insights [28], it has been criticized that the adopter categories, with their stereotypical and value-laden terms, fail to acknowledge adopters as actors who interact purposefully and creatively with complex innovations; the use of adopter categories as explanatory variables for innovation adoption should therefore be avoided [19]. In dealing with later adopters it should also be kept in mind that they have been found to be more likely to discontinue innovations than earlier adopters – either because they lack the necessary know-how to adapt the innovation to their particular circumstances, or because innovations don't fit their economic conditions [28].

Perceived attributes of innovations: The adoption rate of an innovation refers to the length of time required for a certain percentage of the members of a system to adopt an innovation [28]. Much of the variance in innovations' adoption rate is explained by key attributes of innovations as perceived by prospective adopters [19], [28]. Rogers identifies the following key attributes:

- "Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes" [28]. p. 15. In the assessment of an innovation, economic aspects play an important role, but also social prestige factors, convenience, and satisfaction. Thereby, the individual perception is important, and not the *objective* advantage.

- *Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible. The adoption of an incompatible innovation often requires the prior adoption of a new value system, which is a relatively slow process (ibid.).*

- "Complexity is the degree to which an innovation is perceived as difficult to understand and use. […] New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings" [28]. p. 16.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

- *Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible. […] An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing (ibid.).*

- *Observability is the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt. Such visibility stimulates peer discussion of a new idea (ibid.).*

4 Research Questions and Methodology

The primary motivation for our research was to create an instrument that allowed measuring the level of adoption of open data policies and crowdsourcing practices among heritage institutions in Switzerland in order to inform the main stakeholders (heritage institutions, policy makers, as well as open data and free knowledge activists) regarding the developments in this area and to get an overview of the main challenges and driving forces. In the following we will present the research questions, describe the methodological approach and the survey instrument, and discuss the sample biases as well as the limitations of the approach.

4.1 Research Questions

Our main research questions can be summarized as follows:

- Where are Swiss heritage institutions situated in the innovation-decision process regarding the adoption of open data strategies and the engagement in crowdsourcing practices?

- What are the perceived risks and opportunities of open data and crowdsourcing among heritage institutions? What are the driving forces and the hindering factors regarding the diffusion of these innovations?

- What are the expected benefits of open data and crowdsourcing in the heritage domain? Which are the expected beneficiaries?

4.2 Methodological Approach

According to the criteria applied by the national service for the protection of cultural property, there are between 600 and 700 independent heritage institutions with collections of national or regional significance in Switzerland. An estimated total of 1000 independent heritage institutions are organized in three national umbrella organizations (museums, archives, libraries).

For the survey, a subset consisting of all the heritage institutions of national significance in the German-speaking part of Switzerland was selected. The focus on institutions with collections of national significance ensures the institution's relevance with regard to open data and crowdsourcing (excluding for example lending libraries). The limitation to the German-speaking part of Switzerland (which corresponds to a bit more than 60% of all collections of national significance) was due to time and financial constraints.

As the register of collections of national significance lists collections and not institutions, we cleaned out obvious double entries where one institution is responsible for several collections. In some cases we had contact addresses for several sub-divisions of the same legal entity where it isn't apparent from the outside to what extent they act as autonomous entities (e.g. in the case of universities where several sub-divisions have their own libraries or archives). Eventually, 197 organizations were contacted through 233 unique e-mail addresses in the first half of November 2012. After two reminders in 10 day intervals, the online questionnaires had been completed by 72 respondents from 65 different legal entities, corresponding to 34% of the contacted organizations.

Wherever possible, the e-mail invitations were sent to the official contact addresses for the collections – partly personal e-mail addresses of staff members, partly general institutional e-mail addresses. The survey was set up in a way that the link could easily be passed on to other staff members and the questionnaire could be filled in by several people and at different times, thus allowing the institutions to have the most competent staff member reply to a particular question or to gather extra information internally when needed. There is anecdotal evidence that this internal coordination took place and that closely cooperating units that received several invitations to participate in the survey filled in the questionnaire only once. As a side-effect of the flexibility of the questionnaire, several institutions that completed the questionnaire left a small number of questions without a response; these questionnaires were included in the analysis.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

4.3 Survey Instrument

The questionnaire was elaborated in an iterative process: an initial version was produced based on an analysis of existing research literature, interviews with practitioners, and project reports. In a second step, feedback was solicited from different experts from various backgrounds (heritage professionals, open data and open knowledge activists, and researchers), and in a third step, a pre-test was carried out among 10 institutions, accompanied by a follow-up interview in order to better understand respondents' reactions to the questionnaire. After each step, an improved version of the questionnaire was produced.

In its final version, the questionnaire contained 21 questions: Seven questions related to the institutions' characteristics, such as the most characteristic type of heritage items, their main activities, their users, the number of employees, the composition of revenue sources, the institution's legal form, and the percentage of holdings pre-dating 1850. Three questions addressed the issue of metadata exchange with other institutions, metadata quality, and the availability of data and content on the Internet. One question asked whether open data and crowdsourcing (collaborative content creation) was considered important for the institution, and four batteries of questions addressed the risks and opportunities of open data and crowdsourcing respectively. The remaining questions related to the institutions' experience with *free* copyright licenses, their interest for linked data, the role different types of volunteer work (including online volunteers) play for the institution, the involvement of staff members in collaborative projects on the internet, and the institution's interest in further information about open data and crowdsourcing. Wherever possible, a 4-point Likert scale was used. The survey instrument has been published along with the study report and is available online [15].

4.4 Sample Biases

Compared to the entire population of heritage institutions in Switzerland, the sample has several biases that result from the selection criteria:

- All the institutions that were contacted hold collections that are rated as of *national significance* by the government office responsible for the protection of cultural heritage. We can therefore assume that virtually all larger institutions with important collections have been contacted, while smaller institutions and those with less important holdings are underrepresented.

- Institutions in the Italian and French speaking regions of Switzerland were not contacted for reasons of time and cost. Also there are no empirical observations that would suggest any notable differences between the language regions. This selection criterion introduces however a bias in favor of federal institutions and private institutions with a national scope, as many of them are located in the Bern area. On the other hand, the sample does not include the international organizations located in the Geneva region.

Several distortions in the way the institutions responded to the questionnaire were identified (all of them are significant at a confidence level of 95%):

- Archives (43% of contacted institutions) and libraries (34%) were more likely to respond than museums (25%) and *other institutions* (20%). These numbers were calculated on the basis of our own categorization based on the institutions' name and e-mail address.

- Among the institutions that had started to respond to the questionnaire (99 respondents answered at last 2 questions), those holding *art objects* were less likely to complete the questionnaire than the others (54% compared to 79%), while those considering *collecting heritage objects* as one of their core tasks were more likely to complete it than the others (80% compared to 54%).

- Interestingly, those institutions which consider *public authorities* as their main users were less likely to complete the questionnaire than the others (63% vs. 82%).

As most drop-outs took place right after the completion of the first set of questions relating to the general characteristics of the institution, it can be assumed that respondents who did not continue to fill in the questionnaire did not feel sufficiently concerned by questions relating to open data and crowdsourcing. As a consequence, the survey results may be somewhat biased in favor of institutions which think open data or crowdsourcing are relevant.

4.5 Limitations

Due to the small sample size we limited ourselves to analyzing the sample as a whole. We are planning to analyze the influences of various factors on the adoption of open data and crowdsourcing as well as differences between types of institutions in a future study with a larger sample, which will yield more robust results.

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

5 Description of the Sample

A large majority of the responding institutions are either public institutions (58%) or private non-profits (33%). Only 6% are or belong to private, profit-oriented institutions. The sample consists of roughly 43% archives, 29% museums, 15% libraries, and 13% *other institutions*. Around 70% of the overall funding of the institutions in our sample comes from public budgets (institutional funding). Individual funding situations are, however, quite heterogeneous: 68% of the responding institutions receive at least three-quarters of their overall funding from public budgets, while for 24% of the responding institutions, the share of institutional funding in overall revenues amounts to less than one quarter. With regard to the number of employees, the sample contains a good mix of institutions: around 50% of responding institutions are small organizations with less than 5 full-time equivalents, while 10% of the sample is made up of larger organizations with more than 50 full-time equivalents.

Asked about their users, the surveyed institutions most frequently mentioned private individuals (89%), education (89%), and research (73%). Cultural institutions (45%), public authorities (31%), and private enterprises (21%) were mentioned by less than half of the institutions. As to the heritage objects that are characteristic for their institutions, more than half of the respondents mentioned *images, photographs, prints* (56%). Other frequently mentioned object types were *books, periodicals* (46%), *manuscripts, autographs* (44%), and *documents, records* (44%). Roughly one quarter of responding institutions mentioned *film documents* (28%) or *audio documents* (25%), while the other object types – *objects of art* (18%), *technical objects* (14%), *craft artefacts* (10%), and *natural-history objects* (8%) – were mentioned less frequently. (Here and in the following paragraph, we are reporting the items that scored *1 – is the case* – on a 4-point Likert scale.)

The responding institutions show a certain level of homogeneity with regard to their tasks: All the tasks mentioned in the questionnaire scored quite high, with at least 69% of responding institutions considering them at least partly as their core tasks. Thus, over 80% of the responding institutions count *collecting*, *archiving*, and *preparing, indexing, documenting* clearly among their core tasks. On the other end of the spectrum, the least often mentioned tasks were *researching, investigating* (37%), *digitizing* (39%), *lending to other institutions* (42%), *exhibiting* (45%), and *restoring, conserving, preserving* (46%).

6 Main Findings

In this section we relate the main findings with regard to the research questions:

6.1 Diffusion of Open Data and Crowdsourcing

In order to estimate the share of institutions that presently pursue a publication strategy that is in line with the *Open Data Principles*, we looked at the institutions that already make heritage objects available on the Internet and analyzed their responses to the question under which conditions they would make heritage objects available online at no charge. As shown in figure 1, between 1% and 7% of responding institutions make scans/photographs of their heritage objects *freely* available on the Internet. Over half of them make them available on the Internet, but with restrictions. 40% do not make them available at all.

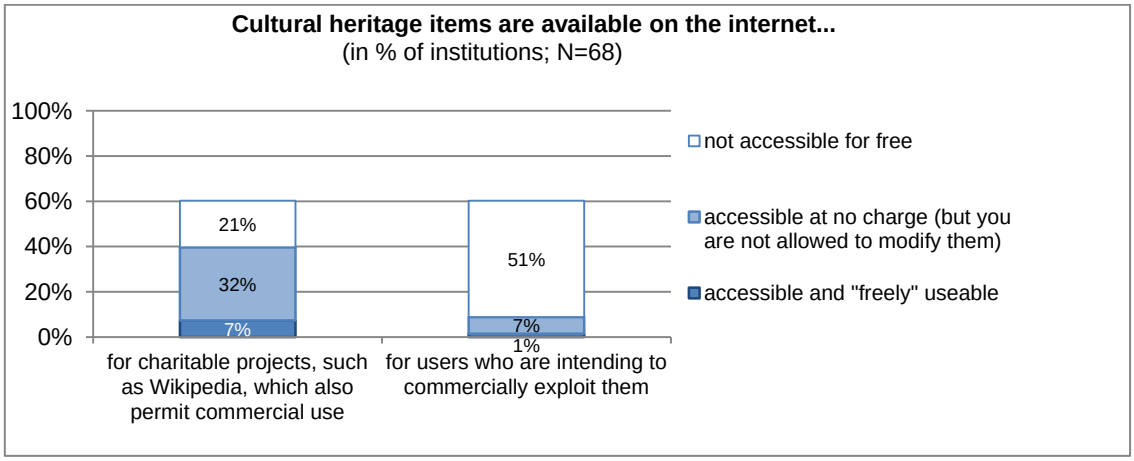


Figure 1: Availability of reproductions of heritage objects on the Internet (and limiting conditions)

When looking in more detail at the conditions under which heritage institutions would make heritage objects *freely* accessible on the Internet (provided that they would not infringe any third party rights or legal requirements), we can observe a descending order as to the type of use they would like to allow: education and research score highest

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

(76% clearly are in favor of free access for these groups), followed by non-profit projects (60%) and private use (59%). When asked about non-profit projects which also allow commercial use of the data, such as Wikipedia, the institutions' readiness to make their works available clearly decreased (29%), but was still much higher than for commercial use only (7%) (see figure 2); the differences between the scores obtained for charitable projects/private use, Wikipedia, and commercial users are significant at a confidence level of 95%.

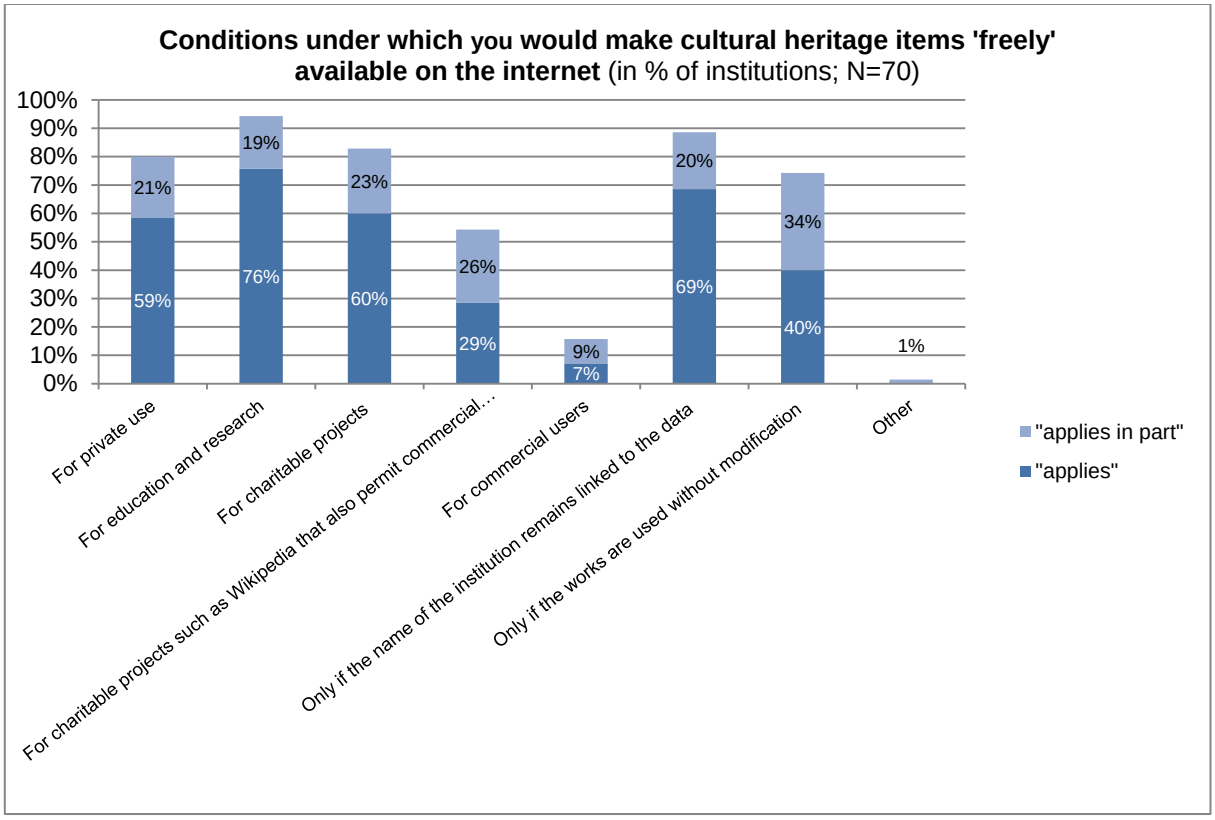


Figure 2: Conditions under which institutions would make cultural heritage items *freely* available on the internet

As the *Open Data Principles* prohibit discrimination with regard to the possible uses of the data, overcoming the reluctance among heritage institutions to admit commercial use of their data/content without requesting payment could be a major challenge. Another challenge results from the fact that 74% of the responding institutions indicated that they would at least partly want to restrict the right to modify the data/content – which is also not in line with the *Open Data Principles*. And finally, the data suggest that over 50% of the heritage institutions which make their heritage objects available on the Internet do not understand that it is impossible to make works available for the use in Wikipedia and to simultaneously prevent their modification and/or their commercial use. In fact, there seems to be a certain lack of awareness of *free* copyright licenses. This is also reflected by the fact that most institutions (83%) indicated that they did not have any experience with alternative licensing models, such as Creative Commons licenses.

Our findings are in line with the observations made in earlier studies that most museums had differential pricing for commercial, nonprofit, and scholarly clients when licensing content, and that fees are often waived for educational and scholarly use [2], [23]. Interestingly, the institutions in our sample seem to be inclined to waive fees for their main user groups, namely private individuals, education, and research. The apparent lack of understanding of *free* copyright licenses is reminiscent of Baltussen's observation that the lack of copyright knowledge and the lack of (up-to-date) information about the copyright status are seriously impeding the ability of cultural institutions to open up their collections [4].

While the above observations point to several challenges when it comes to establishing *free* licensing among heritage institutions, there are other data that suggest that the responding institutions have a rather positive attitude towards open data: When relating the perceived risks to the perceived opportunities, it appears that for 80% of the responding institutions the opportunities of open data outweigh the risks; for more than 40% this is clearly the case. Furthermore, when asked about the importance of open data, more than half of the institutions responded to the affirmative, while only about 20% said that the topic was not important to them. Among those which consider open data to be important, all but one rated the opportunities higher than the risks. This can be seen as a further indicator that we may observe a highly dynamic diffusion of open data in a near future.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

Based on the data collected in our survey (and thus disregarding a possible sample bias), it can be assumed with a probability of 0.95 that 49% to 71% of cultural heritage institutions in Switzerland make at least some of their metadata and representations of their heritage objects available on the Internet. However, no more than 3% provide their content under *free* copyright licenses. At the same time, 72% to 90% perceive open data as an opportunity, and 41% to 65% consider the subject to be of importance. Thus, in terms of the innovation diffusion model, only between 0% and 3% of the heritage institutions in Switzerland had fully adopted an open data policy by the end of 2012, while roughly half of them had reached the interest or evaluation stage.

In order to estimate the share of institutions that already engage in crowdsourcing practices, two indicators were used: staff involvement in collaborative projects and the perceived importance of online volunteering. For both indicators, we got similar results: 11% of responding heritage institutions have staff members who contribute to Wikipedia as part of their professional activity, and 10% of responding institutions say that online volunteering plays partly an important role for them. Interestingly, no correlation was found between the two variables. This seems to indicate that the institutions which have some of their staff members contribute to Wikipedia during their work time do not associate this activity with the online volunteering activity of the wider Wikipedia community.

As for open data, we constructed a crowdsourcing desirability index by relating the perceived risks to the perceived opportunities. It turns out that the surveyed institutions are much less optimistic with regard to crowdsourcing than with regard to open data. For over 90% of them the risks of crowdsourcing are at least as great as the opportunities; for half of them the risks clearly prevail. Adding to this rather pessimistic outlook is the fact that even institutions which perceive crowdsourcing as important (28%) or as very important (10%), think that the risks of crowdsourcing prevail over the opportunities. This could be an indicator that heritage institutions consider it as quite a great and time consuming challenge to enter a cooperative relationship with an existing online community or to launch their own crowdsourcing project. Given the importance attributed to crowdsourcing by at least some of the institutions, it can be expected that they will be willing to confront these challenges as many others have done before them in other countries.

Based on the data collected in our survey, it can be assumed with a probability of 0.95 that between 4% and 18% of heritage institutions in Switzerland are already involved in Wikipedia projects, while 3% to 17% consider voluntary work in the online sector partly as important. There is, however, no significant correlation between the two aspects. While only 1% to 13% of cultural heritage institutions in Switzerland consider crowdsourcing as an opportunity, between 27% and 49% regard it as important. Thus, in terms of the innovation diffusion model, it appears that by the end of 2012, roughly one tenth of Swiss heritage institutions had entered the trial stage with regard to crowdsourcing. However, none of the institutions surveyed seems to have fully embraced the concept. At the same time, roughly one third of Swiss heritage institutions had reached at least the interest or evaluation stage, which is less than in the case of open data (even though this difference is not significant, possibly due to the small sample size).

The findings for open data and crowdsourcing are quite interesting in so far as they point to varying dynamics: While more institutions are already engaging in crowdsourcing practices, there seems to be more enthusiasm for open data. Based on the results of our survey, Swiss heritage institutions can therefore be expected to have higher adoption rates for open data than for crowdsourcing in a few years from now.

6.2 Perceived Risks and Opportunities

The perceived risks and opportunities give us further insights with regard to the driving forces and the hindering factors in view of the adoption of open data policies and crowdsourcing approaches.

6.2.1 Risks and opportunities of open data

When it comes to implementing an open data strategy, the responding institutions are worried most about the extra time effort and expenses to make the data available (86% consider this at least partly as a risk). 59% are also concerned about the extra time needed to respond to inquiries. Further considerable risks are loss of control (68%), potential copyright infringements (66%), violations of data protection laws (51%), and secrecy infringements (35%). Only few of them expect a loss of revenues (a mere 14% thought that this might at least partly be a risk). The opportunities mentioned most often were better visibility and accessibility of holdings (86%), better visibility of the institutions (79%), and better networking among heritage institutions (74%). 36% think that by adopting an open data strategy they would clearly improve the way they fulfill their core mission; 33% think that this is partly the case.

These findings are mostly in line with those of earlier studies [4], [13], [23], although none of them allows for a direct comparison of results. Interestingly, the extra time effort and expenses, which was perceived as the greatest challenge in our survey, was mentioned only by Kelly [23] in form of a need to improve metadata quality and investments in technical infrastructure. In the other two studies, these aspects may have been taken for granted. Similarly, the extra time needed to respond to inquiries, which was perceived as a challenge by more than half of our respondents, was mentioned only by Kelly [23]. In contrast to what might have been expected from the results of the other studies, only very few institutions in our sample were concerned about a potential loss of revenues.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

Regarding possible extra investments needed when making data available online, our survey showed that more than half of the institutions felt that they needed to improve their metadata, while less than a quarter indicated that there was no need for improvement (25% of the respondents said that they couldn't answer this question). Similarly, only 23% of the responding institutions make their reproductions of heritage objects available online. An additional 37% indicated that this is partly the case. These results support Kelly's findings that the need for metadata improvement and investments in technical infrastructure are major challenges for heritage institutions that decide to make their data available under open access regimes.

6.2.2 Risks and Opportunities of Crowdsourcing

With regard to crowdsourcing, most of the risks respondents were asked about received very similar ratings: considerable time/effort needed for preparation and follow-up (72%), difficulties in estimating the time-effort (70%), no guarantee concerning long-term data maintenance (66%), unforeseeable results (61%), and a low level of planning reliability (60%). The only risk that was rated significantly lower was *fears among employees (job loss, changing roles and tasks)* – only 23% of the responding institutions indicated that this could partly be a problem. These findings are in line with Oomen and Aroyo's observation that motivating users for participation and supporting quality contributions are the two major challenges of crowdsourcing [26]. They also support Holley's view that many heritage institutions may be proficient in social engagement with individuals, but that they don't necessarily feel comfortable with setting up a crowdsourcing project [20].

When asked about the opportunities of crowdsourcing, the respondents were rather skeptical. The opportunity that was rated highest was *classification / completion of metadata* (31% of the respondents consider this at least partly as an opportunity), followed by *correction and transcription tasks* (30%), *enhancement and expansion of texts* (25%), *completion of collections* (25%), *crowdfunding* (24%), and *co-curatorship* (14%). Thereby it has to be noted that for the items concerning crowdsourcing opportunities the share of institutions which ticked the *not applicable* field was between 10% and 17% – which is much higher than for all the other risk and opportunity items included in the questionnaire. This could point to the fact that many institutions have not really given much thought to crowdsourcing yet. To our knowledge, this is the first quantitative assessment of the perceived importance of various types of crowdsourcing approaches in the heritage sector. Given the fact that hardly any of these institutions is actually engaging in crowdsourcing approaches, it is however primarily a hypothetical one. It also has to be noted that most of the observed differences in scores are not significant at a confidence level of 0.95, at the exception of the differences between the two highest values on the one hand, and the lowest value on the other hand.

Interestingly, the overall risk assessment by the respondents in our sample was not worse for crowdsourcing than for open data – the average scores are quite similar. What made the difference was the opportunity assessment, which was significantly better for open data than for crowdsourcing.

6.3 Expected Costs and Benefits

Our data suggest that extra time effort and expenses are perceived as the greatest risks or shortcomings of open data and crowdsourcing in the heritage domain. Expected losses of revenue, on the other hand, play virtually no role. This is not really surprising as the institutions in our sample reported that on average only 6% of their revenues derived from commercial activities: 3% from entrance fees, 1% from lending fees, and less than 0.5% from the sale of image rights. In fact, most institutions don't make any money by lending heritage objects or by selling image rights – the two only revenue types that one would expect to be seriously affected by a *free* licensing policy.

Concerning the expected benefits a distinction has to be made between open data and crowdsourcing: While the responding institutions expect only very limited benefits from crowdsourcing, they expect that the adoption of an open data policy would promote the networking among heritage institutions, improve the visibility of their holdings and enhance how these institutions are perceived by the general public.

The institutions were also asked about the main target groups that would benefit from an open data policy. The main target groups mentioned were research (86%), education (79%), private individuals (77%), and cultural institutions (76%). Public authorities (51%) scored significantly lower than the first three groups, and private enterprises (30%) in turn scored significantly lower than public authorities (confidence level = 0.95). These results are largely in line with the respondents' indications concerning the main users of their institutions.

7 Discussion

As the preceding section demonstrates, our research questions could largely be answered based on the data gathered through the pilot survey. The main limitations are the rather small sample size and the inherent inability of quantitative approaches to account for qualitative aspects and developments that have not been taken into account at the time of questionnaire development. As our review of previous research regarding open data and crowdsourcing in the heritage domain has shown, results from various studies have been published in the meanwhile, which are complementary to our approach and need to be taken into account in future quantitative studies.

Journal of Theoretical and Applied Electronic Commerce Research
ISSN 0718–1876 Electronic Version
VOL 9 / ISSUE 3 / SEPTEMBER 2014 / 15-31

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

While most results of our study are in line with those of earlier studies, we found rather surprisingly that very few institutions in our sample are concerned about a potential loss of revenues when adopting open data policies; in fact, they seem very much inclined to waive fees for their main user groups.

There are at least two areas where our study is breaking promising new ground: It is to our knowledge the first quantitative study examining attitudes and practices regarding open data policies and crowdsourcing among a given population of heritage institutions, and it is the first study in this area that uses the innovation diffusion model as a theoretical framework.

7.1 The Results in the Light of the Innovation Diffusion Model

In addition to the state of diffusion of both open data policies and crowdsourcing practices among heritage institutions in Switzerland, we were able to point out different dynamics for the diffusion of open data and crowdsourcing, which merit to be discussed in the light of earlier insights regarding innovation diffusion processes. Rogers [28] identifies a series of variables determining an innovation's rate of adoption: (i) the perceived attributes of innovations; (ii) the type of innovation-decision (optional, collective, or imposed by authority); (iii) the type of communication channels that is used to promote an innovation; (iv) the nature of the social system; as well as (v) the extent of change agents' promotion effort. In the case of Switzerland at the end of 2012, most of these variables can be assumed to be equal for crowdsourcing and open data among heritage institutions. There may have been some differences regarding the type of innovation-decision, as engaging in crowdsourcing was clearly an optional decision for each institution, whereas first official strategies had been formulated during the same year both in view of the adoption of an open government data policy in Switzerland and in view of an improved accessibility of cultural heritage on the Internet [12], [29]. As a consequence, some institutions may have anticipated an official policy in favor of open data when responding to the questionnaire. However, the main difference seems to lie in the perceived attributes of the two innovations.

As set out in section 3.4, Rogers [28] distinguishes between the five perceived attributes of an innovation. In the following, we shall shortly discuss our and earlier findings related to these five dimensions.

*Relative advantage with regard to previous solutions***:** Both open data and crowdsourcing are associated with a set of risks, whereby additional effort and expense are seen as the greatest challenge. Perceived opportunities of open data are however clearly greater than those of crowdsourcing

*Compatibility with existing values, past experiences, and needs of adopters***:** Regarding the adoption of an open data policy, the main cultural incompatibilities lie in the acceptance of *free* licensing of heritage objects, including for commercial use, and surmounting the fear of losing control. Possible losses of revenue are no issue for most institutions, and most of them would readily wave fees for their main users, such as research, education, and private individuals. When it comes to an engagement in crowdsourcing projects, the required cultural change may be more important. Thus, Alam and Campbell [1] describe how the motivations of the National Library of Australia changed as it engaged in a crowdsourcing project, moving from egoistic motives towards a public value orientation related to social engagement. They even conclude that the dynamic change of organizational motivation may be key to the long-term establishment of crowdsourcing practices. In a similar vein, other authors point to a shift in perceptions among cultural heritage professionals, noting that *"*some cultural institutions theorists argue that increased public participation should replace the façade of the infallible, omnipotent voice of the cultural institution with multiple user voices*"* [13]. Lori Phillips, a pioneer in the area of cooperation between heritage institutions and the Wikipedia community, has coined the term *Open Authority*: "At its most basic, Open Authority is the coming together of museum authority with the principles of the open Web, a mixing of institutional expertise with the discussions, experiences, and insights of broad audiences" [27]. She argues that museum professionals need to reconsider the definition of authority in order to remain connected to their communities, both on-site and virtual. Thus, it may well be the case that heritage institutions need to undergo a deep cultural change before being able to fully grasp and reap the benefits of crowdsourcing.

Complexity: The principle of open data is rather simple, especially for institutions which make reproductions of their heritage items already available online. The only thing that they would need to do in order to conform to the open data principles is to use open file formats and to apply a *free* copyright license or a public domain mark. In some cases, there may be additional challenges related to digitizing content or improving metadata quality. Also, for some heritage items there are issues related to copyright, data protection, or classified information. However, as our survey has shown, around 40% of Swiss heritage institutions have sizeable holdings that pre-date 1850, which are not concerned by these issues. It remains however to be seen to what extent this apparent simplicity of open data is confirmed in the longer term. For, as Zuiderwijk and Janssen argue, realizing the benefits of open data usually requires more from the institutions than the mere publication of the data [37]. It is also about stimulating the re-use of data by adapting the institutions' processes to the needs of the data re-users. Feeding enhanced datasets back into the institutions' own systems may further complicate things. So will the enhancement of the data in order to ensure semantic interoperability with datasets from other sources. Yet, only 29% of institutions in our sample indicated that linked data was an issue for them, 6% were planning projects in this area, but none of them had a running project. In contrast, crowdsourcing appeared to the institutions in our sample to be much more complex than open data: for them, crowdsourcing is related to many uncertainties, as they first need to learn how to set up a crowdsourcing

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

project and to effectively interact with a community, be it the one they build up on their own platform or an existing one, such as the Wikipedia community.

*Trialability***:** Both open data and crowdsourcing practices can be set up as projects with a limited scope to gain experiences before making a definitive decision regarding their full adoption.

Observability: The adoption of an open data policy or the engagement in crowdsourcing practices by heritage institutions is rather easy to observe from the outside. It is however much more difficult to understand to what extent such approaches lead to benefits for the institution or third party users of the data/content. Gaining insights into where the real benefits lie usually requires direct contact with people involved in the projects.

In sum, crowdsourcing is perceived by heritage institutions as more complex than open data and isn't readily expected to lead to any sizeable advantages compared to their present situation. Furthermore, adopting crowd-sourcing practices may require deeper cultural changes, although some serious reservations also need to be overcome in the case of open data. It will be interesting to see how perceptions of institutions change when they are embracing these innovations over a longer period of time, and to what extent engaging in open data and crowdsourcing practices will transform the institutions. The findings of some authors would suggest that the benefits achieved through open data may not be as low hanging fruits as perceived by the heritage institutions today, and the question remains to what extent open data and crowdsourcing practices will tend to converge in the future.

Another area where innovation diffusion theory may come into play is the selection of effective communication channels by promoters of innovations. As our survey has shown, in the case of open data and crowdsourcing we are still at a relatively early stage of the innovation-decision process. At the end of 2012, many institutions were still at the awareness stage. They therefore first needed to find out what open data and crowdsourcing are really about. As research has shown, mass communication channels are relatively more important at the awareness stage of the innovation diffusion process, while interpersonal channels are more important at the interest and evaluation stages. Also, mass communication channels are relatively more important than interpersonal channels for early adopters than for later adopters, who can more readily benefit from the information received from peers that already have firsthand experience [28]. Diffusion researchers have also come to distinguish between localite and cosmopolite communication channels. "Cosmopolite communication channels are those linking an individual with sources outside the social system under study. Interpersonal channels may be either local or cosmopolite, while mass media channels are almost entirely cosmopolite" [28]. p. 207. Earlier research has shown that cosmopolite channels are relatively more important at the awareness stage, while localite channels are relatively more important at the subsequent stage. Also, cosmopolite channels are relatively more important than localite channels for earlier adopters than for later adopters [28].

With regard to the most effective communication channels to be used to promote open data in Switzerland, we can thus conclude that given the fact that around half of the heritage institutions are still at the awareness stage, mass communication channels still play an important role. When more and more institutions start embracing open data policies, inter-personal channels to exchange experiences will gain in importance. For early adopters inter-personal channels across national boundaries or outside the heritage domain may be of particular value.

A similar situation results for crowdsourcing: Around 70% of the heritage institutions in Switzerland are still at the awareness stage. Mass communication channels are therefore even more important than for open data. Around 10% have some first experiences in the area; and another 20% have reached the interest or evaluation stage. For these, an exchange of experiences with peers would be helpful.

7.2 Implications for Future Research

As noted above, research into the adoption of open data and crowdsourcing is still rather scarce. Our study has shown a complementarity between qualitative and quantitative approaches. In both areas, further research is needed in order to gain a better understanding of the phenomena surrounding the adoption of these two innovations in the heritage sector.

In particular, we suggest that a similar survey be carried out on a larger scale at an international level. This survey should allow to:

- Make comparisons between museums, archives, libraries: Where do practices converge between the different types of heritage institutions? Where do they diverge?

- Investigate the factors that influence the adoption of open data policies and crowdsourcing practices; taking also into account practices in the area of web 2.0, as well as the latest insights derived from qualitative research (e.g. regarding the self-conception of heritage institutions and their role; driving and hindering factors; perceived risks; etc) and insights derived from research regarding digitization in the heritage sector.

- Further investigate the links between open data and crowdsourcing practices.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

- Investigate the change of perceptions as the institutions implement open data policies or crowdsourcing approaches, e.g. by looking at institutions that are already further advanced in the adoption process.

- Make international comparisons in order to reach a better understanding of differences across countries, for example in relation to the implementation of the EU Directive on the Re-Use of Public Sector Information in the cultural heritage sector, but also with regard to financial considerations or possible differences regarding the diffusion process.

- Further corroborate findings implied by innovation diffusion theory in order to inform practice.

In parallel, we suggest that qualitative approaches be pursued that are complementary to the survey in order to reach a better understanding of the innovation adoption process, the organizational and cultural changes it may entail, and the benefits or disadvantages it may lead to. And last but not least, it might be worthwhile to compare findings related to crowdsourcing and open data for the heritage sector to those from related areas, such as open government data, open access to research data, e-participation, or the use of crowdsourcing in research, in order to get a better understanding of the similarities and differences between these fields. This would most likely encourage cross-pollination between the different strands of research.

8 Conclusions

The pilot survey has provided some valuable insights into the diffusion of open data and crowdsourcing among heritage institutions in Switzerland that are complementary to earlier research in the field. It could be shown where the Swiss heritage institutions stand today with regard to the innovation-decision process, and various driving forces and hindering factors could be pointed out, including a first appreciation of the expected benefits and the main beneficiaries of the innovations.

The results suggest that so far, only very few institutions have adopted an open data / open content policy. There are however signs that many institutions may adopt this practice in a near future: A majority of the surveyed institutions considers open data as important and believes that the opportunities prevail over the risks. Some obstacles however still need to be overcome, in particular the institutions' reservations with regard to *free* licensing and their fear of losing control. With regard to crowdsourcing the data suggest that the diffusion process will be slower than for open data / open content. Although approximately 10% of the responding institutions seem already to experiment with crowdsourcing, there is no general breakthrough in sight, as a majority of respondents remain skeptical with regard to the benefits. We argued that the observed difference in the dynamics of the diffusion of these innovations is primarily due to the fact that crowdsourcing is perceived by heritage institutions as more complex than open data, that it is not readily expected to lead to any sizeable advantages, and that adopting crowdsourcing practices may require deeper cultural changes. Some caveats apply however with regard to the simplicity of open data, if the goal is to foster re-use by responding to data users' needs and preferences, to ensure semantic interoperability between datasets of different institutions, or to re-integrate enhanced datasets into the original ones.

Our data suggest that open data policies are likely to benefit first of all education and research as well as private individuals (the general public). In addition, open data can be expected to facilitate cooperation across institutional borders and to improve the visibility of heritage institutions and their holdings. Eventually, open data might also pave the way for new data visualizations based on linked open data / semantic web technology and for various crowdsourcing approaches. The results of our study suggest however that heritage institutions in Switzerland are still far from having a clear idea how to take profit from these developments. Also, the expected benefits need to be balanced against the costs. In fact, Swiss heritage institutions consider the additional effort and costs related to open data and crowdsourcing as the greatest challenges. In contrast, potential losses of revenue play almost no role.

As a review of previous research has shown, our quantitative approach is complementary to earlier qualitative studies, and our results are mostly in line with earlier findings at the exception that only very few institutions in our sample were concerned about a potential loss of revenues when adopting open data policies. Based on the insights presented in this article we have formulated a set of recommendations with regard to further research, including the carrying out of an international benchmark survey as a natural extension of our pilot survey.

Acknowledgements

My thanks go to Daniel Felder, David Studer, and Markus Vogler for their valuable contribution to the development of the questionnaire, its administration, and the preliminary analysis of the data. Furthermore, I am much obliged to all the people who reviewed the questionnaire and made suggestions for improvement, especially to Doris Amacher (Swiss National Library), Barbara Fischer (Wikimedia Germany), André Golliez (opendata.ch), Frank von Hagel (Institute for Museum Research, Staatliche Museen zu Berlin), Alessia Neuroni (Bern University of Applied Sciences), Hartwig Thomas (Verein Digitale Allmend), and David Vuillaume (Swiss Museums Association), and I am grateful to four anonymous reviewers of the OpenSym 2013 Conference and to three anonymous reviewers of the JTAER

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

special issue for their valuable comments. And last but not least, I would like to thank the JTAER special issue editors for their coordinating efforts.

References

[1] S. Alam and J. Campbell, Dynamic changes in organizational motivations to crowdsourcing for GLAMs in Proceedings Thirty Fourth International Conference on Information Systems, Milan, 2013, pp. 1-17.
[2] N. Allen, Art Museum Images in Scholarly Publishing. Houston: Rice University Press, 2009.
[3] S. Bakker, M. de Niet and G. J. Nauta. (2011, September) Overview of national and international initiatives. Egmus. [Online]. Available: http://www.egmus.eu/fileadmin/ENUMERATE/deliverables/ENUMERATE-D2-01.pdf
[4] L. B. Baltussen, M. Brinkerink, M. Zeinstra, J. Oomen, and N. Timmermans, Open culture data: Opening GLAM data bottom-up, presented at The Annual Conference of Museums and the Web, Portland OR, USA, April 17-20, 2013.
[5] F. Bauer and M. Kaltenböck, Linked Open Data: The Essentials: A Quick Start Guide for Decision Makers, Austria: SEMANTIC-WEB COMPANY, 2011.
[6] G. M. Beal and J. M. Bohlen, The diffusion process, Agriculture Extension Service, Iowa State College, Iowa, Special Report No. 18, 1981.
[7] Bundesamt für politische Bildung. (2011, October) Open Data. Bundesamt für politische Bildung. [Online]. Available: http://www.bpb.de/gesellschaft/medien/opendata/64055/was-sind-offene-daten
[8] L. Carletti, G. Giannachi, D. Price, and D. McAuley, Digital humanities and crowdsourcing: An exploration, presented at The annual Conference of Museums and the Web 2013, Portland OR, USA, April 17-20, 2013.
[9] J. R. Christensen, Four steps in the history of museum technologies and visitors' digital participation. MedieKultur. Journal of Media and Communication Research, vol. 27, no. 50, pp. 7-29, 2011.
[10] K. D. Crews, Museum policies and art images: Conflicting objectives and copyright overreaching. Fordham Intellectual Property, Media & Entertainment Law Journal, vol. 22, no. 4, pp. 795-834, 2012.
[11] J. M. Dooley and K. Luce, Taking our pulse: The OCLC Research survey of special collections and archives. Dublin, Ohio: OCLC, 2010.
[12] E-Government Schweiz, Katalog priorisierter Vorhaben, Stand 24. Oktober 2012.
[13] K. R. Eschenfelder and M. Caswell, Digital cultural collections in an age of reuse and remixes, American Society for Information Science and Technology, vol. 47, no. 1, pp. 1-10, 2010.
[14] E. Estellés-Arolas and F. González-Ladrón-de-Guevara, Towards an integrated crowdsourcing definition, Journal of Information Science, vol. 38, no. 2, pp. 189-200, 2012.
[15] B. Estermann, Swiss Heritage Institutions in the Internet Era. Results of a Pilot Survey on Open Data and Crowdsourcing. Bern: Bern University of Applied Sciences, E-Government Institute, 2013.
[16] European Commission. (2001, July) European content in global networks: Coordination mechanisms for digitisation programmes. Cordis. [Online]. Available: ftp://ftp.cordis.europa.eu/pub/ist/docs/digicult/lund_action_plan-en.pdf
[17] European Commission. (2001, July) Action plan on coordination of digitisation programmes and policies. Cordis. [Online]. Available: ftp://ftp.cordis.europa.eu/pub/ist/docs/digicult/lund_action_plan-en.pdf
[18] European Commission, Information Society DG., and Salzburg Research (firm), The DigiCULT report: technological landscapes for tomorrow's cultural economy: unlocking the value of cultural heritage: executive summary, Office for official publications of the European Communities, Luxembourg, 2002.
[19] T. Greenhalgh, G. Robert, F. Macfarlane, P. Bate, and O. Kyriakidou, Diffusion of innovations in service organizations: systematic review and recommendations, Milbank Quarterly, vol. 82, no. 4, pp. 581-629, 2004.
[20] R. Holley, Crowdsourcing: how and why should libraries do it?, D-Lib Magazine, vol. 16, no. 3/4, 2010.
[21] J. Howe. (2006, June) Crowdsourcing: A definition. Crowdsourcing blog. [Online]. Available: http://crowdsourcing.typepad.com/cs/2006/06/crowdsourcing_a.html
[22] J. Jankowski, Y. Cobos, M. Hausenblas, and S. Decker, Accessing cultural heritage using the web of data, in Proceedings The 10th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST, Malta, 2009.
[23] K. Kelly, Images of Works of Art in Museum Collections: The Experience of Open Access A Study of 11 Museums. Washington DC: Council on Library and Information Resources, 2013.
[24] Z. Manžuch, Monitoring digitisation: lessons from previous experiences, Journal of Documentation, vol. 65, no. 5, pp. 768-796, 2009.
[25] Nicholls, M. Pereira and M. Sani, The virtual museum, LEM The Learning Museum, Bologna, Technical Report 1, 2012.
[26] J. Oomen and L. Aroyo, Crowdsourcing in the cultural heritage domain: Opportunities and challenges, in Proceedings 5th International Conference on Communities & Technologies – C&T 2011, Brisbane, Australia, 2011, pp. 138-149.
[27] L. B. Phillips, The temple and the bazaar: Wikipedia as a platform for open authority in museums, Curator: The Museum Journal, vol. 56, no. 2, pp. 219-235, 2013.
[28] E. M. Rogers, Diffusion of Innovations. New York: Free Press, 2003.
[29] Schweizerische Eidgenossenschaft, Strategie des Bundesrates für eine Informationsgesellschaft in der Schweiz. Eidgenössisches Departement für Umwelt, Energie, Verkehr und Kommunikation UVEK, März 2012.
[30] K. Smith-Yoshimura and C. Schein, Social Metadata for Libraries, Archives and Museums Part 1: Site Reviews. Dublin, Ohio: OCLC Research, 2011.

This paper is available online at
www.jtaer.com
DOI: 10.4067/S0718-18762014000300003

[31] N. Stroeker and R. Vogels. (2012, May) Survey report on digitisation in European cultural heritage institutions 2012. ENUMERATE. [Online]. Available: http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Digitisation-Survey-2012.pdf
[32] N. Stroeker, R. Vogels, G. J. Nauta, and M. de Niet. (2013, September) Report on the enumerate thematic surveys on digital collections in European cultural heritage institutions. ENUMERATE. [Online]. Available: http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Thematic-Survey-2013.pdf
[33] Sunlight Foundation. (2010, August) Ten principles for opening up government information. Sunlight Foundation. [Online]. Available: http://sunlightfoundation.com/policy/documents/ten-open-data-principles/
[34] M. Terras, Digital curiosities: resource creation via amateur digitization, Literary and Linguistic Computing, vol. 25, no. 4, pp. 425-438, 2010.
[35] L. Wyatt, Wikipedia & Museums: Community Curation. Uncommon Culture, no. 2, vol. 1, pp. 33-41, 2011.
[36] A. Zuiderwijk, N. Helbig, J. R. Gil-García, and M. Janssen, Guest editors' introduction. Innovation through open data: A review of the state-of-the-art and an emerging research agenda. Journal of Theoretical and Applied Electronic Commerce Research, vol. 9, no. 2, pp. I-XIII, 2014.
[37] A. Zuiderwijk, and M. Janssen, A coordination theory perspective to improve the use of open data in policy-making, Electronic Government, no. 8074, pp. 38-49, 2013.

2.2 Development Paths towards Open Government – an Empirical Analysis among Heritage Institutions

Paper published in Government Information Quarterly

Development Paths Towards Open Government – An Empirical Analysis Among Heritage Institutions

Beat Estermann

Bern University of Applied Sciences, E-Government Institute, Brückenstrasse 73, 3005 Bern, Switzerland
beat.estermann@bfh.ch

Abstract

In the face of the growing digitization of society, a series of transformations are taking place in the public sector that have been described as the second generation of e-government development. The present article traces how these transformations have been anticipated by successive generations of e-government maturity models and critically assesses existing stage models. Based on a survey among 1560 heritage institutions in 11 countries, an empirically validated maturity model for the implementation of open government is presented. The model uses innovation diffusion theory as a theoretical backdrop. While the model is at odds with the unidimensional nature of the Lee & Kwak Open Government Maturity Model (Lee & Kwak, 2012), the findings suggest that the transformative processes predicted by various e-government maturity models are well at work. They result in increasingly integrated services, participative approaches and an emerging collaborative culture, accompanied by a break-up of proprietary data silos and their replacement by a commonly shared data infrastructure, allowing data to be freely shared, inter-linked and re-used. In order to put our findings into perspective, we take stock of earlier discussions and criticisms of e-government maturity models and offer a new take on the issue of stages-of-growth models in the field of e-government. The proposed approach rests on the assumption of an evolutionary model that is empirically grounded and allows for varying development paths.

Keywords: heritage institution, maturity model, cultural heritage, open government, open data, crowdsourcing, innovation diffusion

This article has been published in the Government Information Quarterly, Volume 35, Issue 4, October 2018, Pages 599-612: https://doi.org/10.1016/j.giq.2018.10.005.

1. Introduction

In the face of the growing digitization of society, a series of transformations are taking place in the public sector that have been described as the second generation of e-government development (Misuraca, 2009): Interactions between government agencies, citizens, and companies are increasingly becoming data-driven, with cross-organizational data integration being a prerequisite for the creation of integrated service delivery and policy enforcement programs (Fountain, 2004; Bekkers, 2013). Institutional hierarchies are being replaced by network modes of interaction, giving way to new forms of participatory approaches and an emerging collaborative culture mediated by the Internet. Public sector organizations participate in this development either by directly involving citizens as co-producers in their service delivery processes or by tapping into self-organized online communities, in which valuable information, knowledge, contacts or experiences are produced, shared and exchanged (Benkler, 2004; Estermann, Riedl, & Neuroni, 2009; Bekkers, 2013; Strokosch, 2013). The increased data exchange, the blurring of organizational boundaries, and the use of participative approaches have led to the rise of new concepts, such as "open data" and "open government", which stress the free sharing and re-use of data across organizational boundaries, government transparency, and the increased involvement of citizens in the dealings of public administration, and call for new forms of governance (Estermann et al, 2009; Chun, Shulman, Sandoval, & Hovy, 2010).

1.1. Research gaps addressed by the present paper

The present paper addresses two notable research gaps: It traces how the second generation of e-government development has been anticipated by successive generations of e-government maturity models and puts two recent models, the Open Government Maturity Model (Lee & Kwak, 2012) and Tim Berners-Lee's five-star model of open data development (Berners-Lee, 2006-2009), to an empirical test. In order to put our findings into perspective, we take stock of earlier discussions and criticisms of e-government maturity models, which have been a recurrent topic in the *Government Information Quarterly* (cf. Layne & Lee, 2001; Andersen & Henriksen, 2006; Gil-Garcia & Martinez-Moyano, 2007; Yildiz, 2007; Gottschalk, 2009; Klievink & Janssen, 2009; Lee, 2010; Andersen, Medaglia, Vatrapu, Henriksen, & Gauld, 2011; Concha, Astudillo, Porrua, & Pimenta, 2012; Lee & Kwak, 2012; Maheshwari & Janssen, 2013; Veljković, Bogdanović-Dinić, & Stoimenov, 2014), and offer a new take on the issue of growth models.

Furthermore, the paper gives an account how the transformations described above materialize in the cultural heritage sector, a sector adjacent to classical public administration which has not

received much focus in the e-government literature so far. Based on a survey among 1560 heritage institutions in 11 countries, an empirically validated maturity model for the implementation of open government in the heritage sector is presented, which provides an answer to the two key research questions covered by the paper, namely: Is there a typical path heritage institutions follow when adopting Internet-related practices? And if so, to what extent do the data provide evidence for the validity of the Lee & Kwak Open Government Maturity Model and Tim Berners-Lee's 5-star model of open data maturity?

1.2. Specifics of the cultural heritage sector

The cultural heritage sector is made up of institutions such as museums, libraries, archives and records offices, and other organizations with curatorial care of a heritage collection (Nauta, Bakker, & de Niet, 2011). While some heritage institutions are governed by public law, many others are constituted as private non-profit organizations, a large fraction of which are mainly publicly funded and thus directly affected by public funding policies. While heritage institutions have received little attention so far in the e-government literature, we would expect them to be particularly prone to embrace the transformations described above, due to several factors:

- First, the heritage sector has traditionally been composed of both private, public, and hybrid institutions (Hammack, 1989; Schuster, 1998; Johnson & Thomas, 1998); a certain permeability between the public and private sectors and cross-sector cooperation between institutions with very similar missions therefore appear quite natural.
- Second, many heritage institutions have a long-standing history of relying on volunteer work (Johnson & Thomas, 1998), a form of citizen participation that precedes the more recent calls for increased citizen participation through online channels.
- And third, the Wikimedia/Wikipedia community, one of the largest collaborative online communities, has a decade-long track record of actively engaging and cooperating with heritage institutions (cf. Oomen & Aroyo, 2011). As a result, there are plenty of opportunities for heritage institutions to open up their collections, to engage with online volunteers, and to foster online collaboration around their holdings.

Like classical public administration, the cultural heritage sector has undergone important changes since the advent of the World Wide Web that have manifested themselves in form of successive and sometimes overlapping trends (Estermann, 2014): Since the break of the millennium, digitization of heritage objects and their metadata has been defined as a strategic goal on national and international levels (as exemplified in Europe by the Lund Action Plan for Digitization), leading to increased cooperation and coordination among heritage institutions in

order to provide a single-point-of-access to common catalogues, to create virtual libraries, or to coordinate digitization efforts and long-term archiving. As a result, digitization not only played a role in preserving cultural heritage, but also greatly enhanced access to collections for wider audiences. Half a decade later, heritage institutions started to embrace the use of web 2.0 tools, such as Facebook or Twitter, to get their message out to their publics, and to engage them in conversations. In some cases, institutions even engaged their users/visitors in collaborative production processes, either by launching their own crowdsourcing applications or by cooperating with existing online communities, such as Wikipedia. Early examples of such activities among heritage institutions date back to 2006 with predecessors among non-profit endeavors, such as the "Distributed Proofreaders" project that supports the development of e-texts for Project Gutenberg and was formed in 2000 (Holley 2010). Further trends include the adoption of open data policies and the integration of data across institutional borders thanks to linked data technology. There have been a few attempts to put these different trends into perspective (e.g. Evans, 2007; Oomen & Aroyo, 2011), and some of the new emerging practices have been subsumed under the term "OpenGLAM" – the equivalent of "open government", applied to the cultural heritage sector (the acronym "GLAM" stands for *galleries, libraries, archives, and museums*) (OKFN, 2013).

2. E-Government Maturity Models

There is no universally accepted definition of the concept of e-government (Yildiz, 2007; Concha, Astudillo, Porrua, & Pimenta, 2012), and as the authors of the ninth edition of the UN E-Government Survey note, the concept has greatly evolved over time to include new insights gathered and reflections made throughout the implementation process (UN, 2016, p. 143). Following UN & ASPA (2001), e-government can be defined as "utilizing the Internet and the World-Wide-Web for delivering government information and services to citizens". Other definitions underline the role of ICT in supporting public sector reform and in improving the quality and efficiency of public services, or point to the organizational change e-government brings about (Grant & Chau 2005; Grönlund 2010; Concha et al., 2012; UN, 2016).

2.1. Mapping the first generation of e-government development

A tool that has been widely used for sense-making and leading change in the field of e-government are maturity models or "stage models", the most cited one being the Layne & Lee (2001) model which describes four stages on the way to "fully functional e-government". All in all, around 20 e-government stage models were published between 2000 and 2012, out of which all but one focus on the first generation of e-government development. They are similarly

structured and consistent with the view that e-government passes through the following cumulative stages (Lee, 2010; Fath-Allah, Cheikhi, Al-Qutaish, & Idri, 2014):

- online presence (characterized by the availability of government information on the Web);
- interactivity (characterized by the possibility of two-way online communication between government and citizens);
- transaction (characterized by the possibility to complete transactions online);
- integration (characterized by cross-agency integration of services – both horizontally and vertically across different levels of government – which typically manifests itself in a nation-wide one-stop shop, or several one-stop shops for different target groups, in seamless services for citizens, and in the integration of back-office systems).

While some of the early empirical research had been dubitative as to the validity of the latter of these stages (Torres, Pina, & Royo, 2005; Bekkers & Homburg, 2007; Coursey & Norris, 2008), empirical studies among US local governments have largely confirmed the first three stages (Moon, 2002; West, 2004; Norris & Reddick, 2013), while the successive editions of the UN E-Government Survey have documented the progress through the four stages at the level of national governments (UN & ASPA, 2001; UN, 2003-2016).

2.2. Fields of application

The basic idea behind stage models is that descriptive stages can be used in a prescriptive manner, serving as learning models for organizations to help them move from one stage to the next (Klievink & Janssen, 2009). Stage models have a long history in organization and management research (Gottschalk 2009). Their application in the field of information systems has its origins in organizational learning (DeBrí & Bannister 2015). Stage models have been used by change advocates, managers and policymakers for benchmarking and monitoring purposes, to formulate strategic roadmaps, to make public servants aware of future developments, to stimulate the developments of capabilities needed by organizations to migrate from one stage to another, to facilitate joint action and knowledge-sharing among government agencies, to provide milestones to evaluate and control the cost of architecture development, and to identify and disseminate best practices (Janssen & Van Veenstra, 2005; Siau & Long, 2005; Gottschalk, 2009; Klievink & Janssen, 2009; Andersen & Henriksen, 2006; Concha et al., 2012; Fath-Allah et al., 2014). Furthermore, they have been used by researchers to evaluate

and understand e-government development and to capture the overall vision of e-government (Siau & Long, 2005).

2.3. Limitations

Traditional stage models assume that stages are sequential in nature, and that they occur within a hierarchical, and often irreversible progression (Klievink & Janssen, 2009). There is some debate in the literature as to whether the stages correspond to predictable patterns in the development of organizations which are marked by discontinuity (ibid.) or whether they rather represent "discrete points in a continuous development process within the organization" (Andersen & Henriksen, 2006). Some empirical studies have concluded that there are no discernable steps or stages in e-government and that governments rather adopt e-government incrementally (Coursey & Norris, 2008; Norris & Reddick, 2013). This is in line with the observation that in practice, within a given organization at a given point in time, different elements of e-government may be situated in different phases of the stage model (Siau & Long, 2005; Davison, Wagner, & Ma, 2005; Andersen & Henriksen, 2006; Gil-Garcia & Martinez-Moyano, 2007). Furthermore, several authors have pointed to the fact that the development of e-government is not linear and that individual organizations do not necessarily need to go through all the stages sequentially. There may be different reasons for this: later adopters may learn from frontrunners and jump certain stages, some organizations may not have the resources and capabilities needed to reach the highest growth stages, some organizations may lack client groups or types of services that require the higher stages, and some may have different political priorities (Moon, 2002; West, 2004; Davison et al., 2005; Coursey & Norris, 2008; Klievink & Janssen, 2009; Lee, 2010; DeBrí & Bannister, 2015). Thus, although they sometimes pretend to be prescriptive and normative, e-government stage models present a development trend rather than a must-go-path (Siau & Long, 2005; DeBrí & Bannister, 2015), and there may be multiple paths through the stages (Gottschalk 2009).

E-government stage models are meant to focus attention on particularly relevant aspects of e-government. Authors do not necessarily agree on what the most relevant aspects are. Several authors have pointed to what they consider to be the blind spots of earlier models, and some of them have proposed their own model to remedy the situation. Thus, Andersen et al. (2011) argue that while there is a large pool of models focusing on technological and organizational integration from a supply side perspective, the user perspective is lacking. Kalampokis, Tambouris, & Tarabanis (2011) on the other hand consider that traditional e-government stage models, by focusing on service provision, do not sufficiently take into account the aspect of

data integration. Similarly, DeBrí & Bannister (2015) contend that, given their outward-facing view of e-government, e-government stage models do not adequately take into account politics or important technologies, such as data analytics, artificial intelligence, or cloud computing. They also criticize that the models typically lack the multi-dimensional perspective that would be needed to measure value for money in ICT investment. In the same vein, Grönlund (2010) warns that e-government stage models could be detrimental when used as the sole guide by decision-makers, as they avoid complex issues of e-government by neglecting policy challenges with regard to privacy protection, accountability, and other public-sector values.

Further criticism of e-government stage models roughly falls into one of the following categories:

- Stage models lack a theoretical foundation and are often not empirically validated, which is especially true for later development stages the descriptions of which tend to be highly speculative and overly optimistic (Andersen & Henriksen, 2006; Coursey & Norris, 2008; Klievink & Janssen, 2009; Van Veenstra, Klievink, & Janssen, 2009; Maheshwari & Janssen, 2013; DeBrí & Bannister, 2015).
- The way stage models are sometimes applied does not transcend the level of individual organizations and thus misses the role played by inter-organizational collaboration, as some of the functions of later development stages may be realized at the level of network organizations, and not necessarily within individual organizations (Janssen et al., 2008; Klievink & Janssen, 2009).
- There is little or no consideration of change mechanisms, change management and organizational development strategies in the models (Janssen & Van Veenstra, 2005; DeBrì & Bannister, 2015). Stage models typically do not list the capabilities needed by organizations to evolve from one stage to the other and hardly provide any guidance on how to structure the information architecture's maturity process, which makes them less useful for organizations (Davison et al., 2005; Janssen & Van Veenstra, 2005; Klievink & Janssen, 2009; Maheshwari & Janssen, 2013); some authors have therefore complemented the stage models accordingly (Janssen & Van Veenstra, 2005; Klievink & Janssen, 2009; Kim & Grant, 2010; Chen, Yan, & Mingins, 2011).
- Stages-of-growth models are often based on intuitive, appealing models without providing any guidance to determine in which stage an organization is (Maheshwari & Janssen, 2013).

There is a further strand of criticism related to e-government benchmarking, which is not limited to stage models, but applies to any quantitative evaluation of progress: Are the right variables being measured? And, if several different variables are involved, how do we know that the method for weighing them is correct? – As Bannister (2007) notes, e-government rankings are likely to have a negative impact if the benchmarkers do not have their priorities right. Like rankings, maturity models are employed to focus practitioners' attention and tend to be the driver for national e-government policies and governance structures (Andersen et al., 2011) – if the focus is on the wrong aspects, this has nefarious effects. It is therefore important to critically assess the effects and biases of such instruments and to identify their beneficiaries and blind spots (Bannister, 2007; Andersen et al., 2011). As with other quantitative evaluation approaches, there is a tendency to measure what can easily be measured, while soft factors and socio-technical aspects are neglected (Maheshwari & Janssen, 2013). Thus, e-government stage models that have been devised primarily with quantitative evaluation in mind may focus on what is easily observable (e.g. features of government websites) at the expense of what might be more relevant, but less prone to be observed by outsiders. When assessing stage models used for benchmarking purposes it should also be kept in mind that, according to the study of complex systems, the relevant indicators for e-government advancement are typically not identical with the aspects that should be focused on when trying to make the system evolve in the desired direction (Ninck, Bürki, Hungerbuehler, & Mühlemann, 2014). – The relationship between good indicators and the system components that should be acted upon to achieve sustainable change is like the one between the symptoms and the root causes of an illness: We may measure the body temperature to judge how ill we are, and we may use medication to reduce the fever, but if we want to actively influence the recovery process, we need to understand the root cause of our illness and the mechanisms leading to the symptoms in order to intervene at that level. In the same way, benchmarking tools may primarily focus on taking the temperature and not on providing guidance as to how to improve the situation in the longer term. This does not automatically make them bad benchmarking tools, as they may perfectly fulfill their purpose. However, those who put the insights from the benchmarks into practice should be aware of the workings of complex systems, lest they waste too much energy on trying to change symptoms instead of acting on factors that provide them with some real leverage to change the system.

2.4. Shedding light on the e-government nirvana

Several e-government stage models do not end with the "integration" stage, but predict some further e-government development or transformation. Criticizing its speculative nature,

Coursey & Norris (2008) have dubbed this last stage of e-government development somewhat polemically the "e-government nirvana". Others have pointed out that the development of stage models is never complete, but an ongoing process that is influenced by technological developments (Klievink & Janssen, 2009). Thus, by analyzing the various descriptions of the last stages of e-government development, we may be able to reach a better understanding of what characterizes the second generation of e-government development, which is presently unfolding and has been referred to as "open government". In the remainder of this section, we will therefore provide an overview of the later stages of e-government development as depicted by the first-generation maturity models and by analyzing the discursive shift that has occurred throughout nine editions of the UN E-Government Survey (2001-2016). We will conclude the section by discussing the Open Government Maturity Model (Lee & Kwak, 2012), which attempts to capture some of the next stage(s) of e-government development and can be thought of as a logical extension of the first-generation models discussed in section 2.1.

While some stage models suggest that e-government culminates in the break-through of governmental silos, in the provision of seamless services irrespective of organizational boundaries (Wescott, 2001), the radical adoption of a user-centered perspective (Deloitte Consulting & Deloitte & Touche, 2000; Baum & Di Maio, 2000; Windley, 2002; Rohleder & Jupp, 2003; West, 2004; Andersen & Henriksen, 2006; Klievink & Janssen, 2009; Lorincz et al., 2009), and/or in the use of online tools to facilitate citizen participation, including e-voting (Hiller & Bélanger, 2001; Wescott, 2001; Moon, 2002; Netchaeva, 2002; West, 2004; Shahkooh, Saghafi, & Abdollahi, 2008; Almazan & Gil-Garcia, 2008; UN, 2012), others go a step further and envision groundbreaking changes:

- Several authors anticipate that e-government will enable new forms of political participation and citizen engagement; they stress its role in empowering civil society and in changing the way people make political decisions (Hiller & Bélanger, 2001; Wescott, 2001; Netchaeva, 2002; Moon, 2002; Siau & Long, 2005; Lee, 2010; UN, 2012).
- While a number of authors stress the importance of data and information sharing between various government agencies (Moon, 2002; Windley, 2002; Alhomod & Shafi, 2012), Andersen & Henriksen (2006) postulate in addition that data sharing will increasingly extend beyond the public sector to also involve private sector companies in the provision of seamless services to citizens. At the same time, they anticipate that

data ownership will be transferred to customers and that database infrastructures will be designed to primarily serve end-users.

- According to Andersen & Henriksen (2006), the prevalent division between inside and outside the governmental organization will increasingly be abandoned, leading to enhanced accountability and transparent processes.

One could argue that the less radical vision of e-government development describes the latest instalment of public sector reform or, in other words, the logical conclusion of the New Public Management (NPM) agenda. NPM is an approach to running public sector organizations that was developed during the 1980s in response to some of the shortcomings associated with traditional public administration. As NPM was implemented differently across countries, its exact characteristics vary from country to country, but the main guiding theme is that government works more efficiently if it follows private-sector principles instead of the rules of a rigid hierarchical bureaucracy (Dunleavy & Hood, 1994; Hood, 1995; Pollitt, 1995). This included the disaggregation of large public-sector hierarchies into smaller structures, the introduction of competitive elements through market-like arrangements, and the increased use of pecuniary-based performance incentives for staff, accompanied by a shift in accounting principles and an increased focus on service quality and customer responsiveness (Hood, 1991; Dunleavy & Hood, 1994; Pollitt, 1995; Dunleavy, Margetts, Bastow, & Tinkler, 2006). In this context, e-government can be seen as a means to realize efficiency gains and to reconcile the disaggregation of the public sector with a user-centered perspective by implementing seamless services across governmental silos.

In contrast, the more radical vision of some authors points to something qualitatively new, marking the beginning of the post-managerial era by breaking free from some of the precepts of NPM, such as the reliance on market mechanisms, or the conceptualization of citizens and users as “clients” (cf. Bellamy & Taylor, 1998; Hughes, 2003; Chadwick & May, 2003; Dunleavy et al, 2006; Nam, 2012; Abdelsalam, Reddick, Gamal, & Al-Shaar, 2013).

This shift to a more radical vision of e-government can also be observed in the discourse throughout the different editions of the UN E-Government Survey, where several features of later stages of e-government development become increasingly prominent: Citizens are no longer passive consumers of government-provided information but act increasingly as co-producers of services (UN, 2010). Web 2.0 tools and crowdsourcing approaches empower citizens and allow them to become content creators (UN, 2008; UN, 2014). Open data is expected to enhance public sector efficiency by allowing third parties to provide innovative

services (UN, 2010) and to enable effective collaborative governance by better equipping citizens to partake in public decision-making processes (UN, 2012; UN, 2014). In sum, the reports point to a paradigm shift in the role of the public sector, characterized by the concepts of "government as a platform", i.e. as a "provider of data and services for others to exploit as they see fit" (UN, 2010, p. 16), "open government", building on "principles of citizen centricity and information transparency" (UN, 2012, p. 109), and "collaborative governance" (UN, 2014), based on collaboration between government and non-government stakeholders. Governments become catalysts for change instead of mere service providers, facilitate networked co-responsibility by empowering communities to take part in the solution of their own problems, and become entrepreneurial in generating revenues and promoting partnerships (UN, 2014, p. 77).

2.5. Need for a model covering the later stages of e-government development

While there is partial convergence in how different authors envision the later stages of e-government development, one could argue that we have arrived at a point similar to the one almost two decades ago when the first generation of stage models were created: there was a lack of orientation among practitioners as to how to go about implementing e-government (Layne & Lee, 2001). To remedy today's lack of orientation, Lee and Kwak (2012) presented an integrated "Open Government Maturity Model" that captures these later phases of e-government development. It can be seen as an extension of the earlier stage models.

The model takes its name from the "Open Government Directive" introduced by the Obama administration in 2009, which emphasized three principles of open government: transparency, participation, and collaboration – an initiative that has later been extended to other countries in form of the international "Open Government Partnership" (Lee & Kwak, 2012; Veljković et al., 2014).

Based on the findings from five case studies with US healthcare administration agencies, Lee & Kwak argue that there is a logical sequence for advancing open government, which government agencies should follow in order to harness the power of social media effectively. They posit that the first step in the development towards open government consists in opening up data (**data transparency**), followed by the introduction of participatory elements based on "expressive" social media and web 2.0 tools (**open participation**). At this stage, government agencies *"strive to crowdsource the public's ideas, knowledge, expertise, and experience through voting, polling, contest, blogging, microblogging, ideation, etc."* (Lee & Kwak, 2012,

p. 498). The next step consists in fostering **open collaboration** among government agencies, the public, and the private sector. In contrast to open participation, where public engagement occurs in form of relatively simple interactive communications, open collaboration involves public engagement in complex tasks or projects that aim to co-create specific outputs. The last stage in their model is termed **"ubiquitous engagement"** and is characterized by the seamless integration of government data, public engagement methods, social media tools, and government services. This last stage remains however a vision for the future, as none of the open government initiatives examined had reached it.

Veljković et al. (2014) have proposed a benchmarking framework that bears some similarities to the Lee & Kwak model. They suggest operationalizing the notion of "open government" through concepts such as "open data", "data transparency", "government transparency", "participation", and "collaboration". While providing detailed guidance on how to operationalize the first three concepts, they fail to explain how to measure the levels of "participation" and "collaboration". They also propose a measure for open government maturity, related to the government's readiness for change and its embracement of open concepts and referred to as "the speed of government progress" (Veljkovic et al., 2014, p. 285), which rests on the somewhat naïve assumption that progress is linear and speed is constant.

Complementary stage models have been proposed that focus on the data perspective and are not necessarily specific to the government sector, such as Tim Berners-Lee's (2006-2009) 5-star-model for open data maturity, which postulates a gradual development from closed data to open data through to linked open data. The vision of linked data consists in extending the concept of the World Wide Web as a network of decentralized, but interlinked resources to the domain of data. The goal is to create a giant, decentralized database allowing computers to answer queries based on information found on many different websites, the "Web of Data" (Bizer, Heath, & Berners-Lee, 2009; Heath & Bizer, 2011). Kalampokis et al. (2011) propose an "Open Government Data" stage model, which focuses on the aspect of data integration. They remain however unclear as to how their model relates to earlier e-government stage models: While the two earlier stages (**"aggregation"** and **"integration of government data"**) seem to correspond to the "integration stage" of the first generation e-government stage models, the two later stages (**"integration of government data with non-government formal data"** and **"integration of government data with non-government formal and social data"**) are reminiscent of the speculative last stages of some of these models.

Various studies have presented empirical findings regarding the progress that has been made by governments in implementing different aspects of open government, but so far none of the quantitative studies has captured all the aspects present in the Lee & Kwak model:

- Several studies have traced the dissemination of web 2.0 use among governments: Mainka, Hartmann, Stock, and Peters (2014) investigated the social media activities of 31 cities that were expected to be particularly well-equipped for the knowledge economy. They found that 29 of them used at least one of the social media services and that on average, four services were used per city government. The most frequently used service was Twitter, followed by YouTube and Facebook. Analyzing the online presence of 75 EU cities, Bonsón, Torres, Royo, and Flores (2012) found that while most city governments were using social media tools to enhance transparency, the concept of corporate dialog and the use of web 2.0 to promote e-participation were still in their infancy. The authors concluded that social media was simply used as another way to provide information and services to external audiences and that, for the moment, there was no significant revolution in government-to-citizen relationships in sight. These findings are consistent with the findings of several other studies (Brainard & McNutt, 2010; Hand & Ching, 2011; Hsu & Park, 2012; Abdelsalam et al., 2013; Mossberger, Wu, & Crawford, 2013).
- The most notable surveys tracing the progress of open government data on a global scale are the Web Foundation's Open Data Barometer (Web Foundation, 2017) and the Open Knowledge Foundation's Global Open Data Census (Lämmerhirt, Rubinstein, & Montiel, 2017). Both surveys focus on the publication of open government data in a limited number of thematic areas, postulating that a series of standard datasets should exist in every country (Estermann, 2016a). In their 2017 editions, both surveys concluded that only a small fraction of published data was available as open data. According to the Open Data Barometer, among the 1725 datasets that were assessed from 15 different sectors across 115 countries, only about 7% were fully open (i.e. machine-readable and published under an open license).

Like for classical public administration, the web 2.0 also creates new opportunities for heritage institutions and their communities of interest. It allows them to actively use and reuse cultural heritage content and provides them with opportunities for building cross-institutional collections (Liew, 2014). While some authors point to the great transformative power of social media, leading to a change in the relationship between heritage institutions and their publics

towards more interactive and collaborative forms, first empirical evidence suggests that these changes are unfolding rather slowly:

- Based on in-depth analyses over three months' Facebook communication at nine Danish museums, Gronemann, Kristiansen, & Drotner (2015) have found little change in perceived institutional roles. Similarly, Capriotti & Pardo Kuklinski (2012), who analyzed the use of web platforms and social web applications as tools for dialogic communication by 120 museums in Spain, concluded that the way institutions communicate with their audiences has hardly changed. These findings are echoed by the results of a survey among 370 libraries and archives investigating their use of social media: *"there is a large gap between the vision of social media usage by cultural heritage institutions, as reflected in the literature and the reality of actual implementation"* (Liew, Wellington, Oliver, & Perkins, 2015, p. 393). In fact, most heritage institutions were found to use social media as a one-way communication tool, and only about 20% were found to be pursuing participatory objectives, and less than 5% indicated a holistic, transformative vision in connection with their social media use.
- As regards the adoption of open data among heritage institutions, no quantitative studies have been published apart from our own research (Estermann, 2013, 2014, 2015, 2016a, 2016b). There is also still very little research on linked data adoption. Several authors (Yoose & Perkins, 2013; Edelstein et al., 2013; Cagnazzo, 2017) have provided first overviews of existing linked data projects in the heritage sector. They unanimously conclude that linked data adoption is still in its infancy, with many projects merely at a proof-of-concept stage.

3. Method of Data Collection

The analyses presented in this article are based on data gathered by means of an online survey among heritage institutions in eleven countries, carried out between 2014 and 2017. The survey was organized in a federative manner, relying on national teams in the participating countries which were mainly recruited from NGOs promoting open data and free knowledge.

There is an initial sampling bias given the fact that institutions without a publicly available email address have not been contacted. The percentage of institutions thus excluded from the survey ranges between less than 5% (e.g. Switzerland) to around 20% (Brazil). No extra efforts were made to reach these institutions, as the survey would not have made much sense thematically to most of them. Given the fact that no country comparisons are made, this bias is

irrelevant in the context of this article. The same goes for the heterogeneity of the heritage sectors in the participating countries and the differences regarding the responding behavior of institutions across countries.

3.1. Survey instrument

The questionnaire contained 34 questions covering the institutions' characteristics as well as their attitudes towards and effective adoption of various Internet-related practices. The questionnaire was elaborated in an iterative process: an initial version was produced based on the questionnaire of a Swiss pilot survey (Estermann, 2013) and the ENUMERATE Core Survey 2 (Stroeker & Vogels 2014), and complemented by new questions based on a thorough review of previous research regarding open data, crowdsourcing, and social media in the heritage sector (Estermann, 2014). This initial version was reviewed and discussed by a number of scholars and practitioners in the field of cultural heritage as well as by OpenGLAM activists from various countries in an open feedback process that led to a revised version, which in turn was pretested among a small number of institutions. The questionnaire in its various language versions is available for download on the project portal[1].

3.2. Definitions of key concepts

The following definitions were used in the questionnaire:

- **'Metadata'** refers to the data used to describe the heritage objects held by the institutions.
- **'Open data'** refers to data that is made available on the Internet in a machine-readable format to be freely used, modified, and shared by anyone for any purpose.
- **'Linked data'** refers to structured data that is interlinked with data from other data sources based on standard web technologies such as HTTP, RDF, and URIs.
- **'Digitization'** refers to the digital reproduction of heritage objects; in the case of three-dimensional objects, for the purpose of the survey, the term refers to their documentation by digital photography or digitization of older photographs of the objects.
- **'Open content'** refers to making digital copies/images of heritage objects available on the Internet to be freely used, modified, and shared by anyone for any purpose.
- **'Social media'** comprises social media in the broadest sense of the term: social or professional networking sites, microblogging services, video or photo sharing sites,

[1] http://survey.openglam.ch

social bookmarking or cataloguing services, blogs, collaborative online communities, as well as social media functionalities built into institutional websites.

- **'Crowdsourcing'** refers to situations where an institution proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task, that usually would be performed by staff members (Estellés-Arolas & González-Ladrón-de-Guevara, 2012); the term **'collaborative content creation'** was used alternatively to refer to crowdsourcing situations where online collaboration among volunteers is involved.

3.3. Description of the sample

The countries covered are Brazil, Bulgaria, Finland, New Zealand, Poland, Portugal, Spain, Switzerland, The Netherlands, Russia, and Ukraine. The selection represents a convenience sample of countries for which a nearly complete list of heritage institutions and their email addresses could be assembled and for which high quality translations of the questionnaire were provided. Institutions were sent an invitation email and up to two reminder emails. 1560 institutions completed the questionnaire. The overall response rate for the eleven countries was 9.6%, with significant differences among the countries: The highest response rate was achieved in Finland (25.8%), followed by Switzerland (19.5%); the lowest rates were obtained for Spain (5.9%) and Brazil (6.3%).

A large majority of the responding institutions are either public institutions (69%) or private nonprofits (23%). Only 1% are (part of) private, profit-oriented institutions. 7% of respondents indicated that their institution has a mixed form (e.g. premises provided by a public institution; exploitation taken care of by a private nonprofit). 70% of responding institutions are predominantly funded by public funds.

Regarding their size, the sample contains a good mix of institutions: 51% of responding institutions are small organizations with a total annual budget of 100'000 euro or less, while 12% report an annual budget of at least 1 million euro. Similarly, 51% have no more than 5 FTE paid staff, while 20% report at least 25 FTE staff.

Asked about their main users, the surveyed institutions most frequently mentioned private individuals (93%), education (83%), and research (52%). Regarding their geographical reach, 49% of institutions reported that they had a "local/regional" focus, compared to 25% with a "regional/national", 21% with a "national/international", and 6% with a "global" focus.

4. Method of Analysis

The goal of the empirical part of the present article is to shed light on the dissemination of Internet-related practices associated with the latter stages of e-government development in the heritage sector. To do so, an empirically grounded maturity model for the development of Open Government – or more specifically OpenGLAM – is developed. This model is in turn compared to existing theoretical models of Open Government development – mainly the Lee & Kwak Open Government Model as well as Tim Berners-Lee's 5-star model of open data maturity.

4.1. Research questions

The main research questions can thus be summarized as follows:

> **RQ 1:** Is there a typical path heritage institutions follow when adopting Internet-related practices that could serve as a basis for an OpenGLAM Maturity Model?
>
> **RQ 2:** To what extent do the data provide evidence for the validity of the Lee & Kwak Open Government Maturity Model and Tim Berners-Lee's 5-star model of open data maturity?

By positing that e-government typically evolves through a set of stages in a precise order, e-government stage models imply that there is a 'natural' development path that institutions should follow in their evolution towards 'higher' stages of e-government. As stage models are used to guide institutions' change processes and to evaluate progress, it is important to make sure that the order of stages is empirically valid.

4.2. Operationalization of innovation adoption and diffusion

As has been noted in the literature, stages in e-government development are artificial constructs. In reality, public organizations adopt e-government incrementally, and different units of the same organization may be situated in different phases of the stage model. Also, individual organizations do not necessarily need to go through all the stages sequentially. Taking these observations into account, we translated the hypothetical stages into concrete innovative practices and drew on innovation diffusion theory to operationalize their incremental adoption by individual organizations. Following innovation diffusion theory, the diffusion of an innovation is a social process that unfolds as the members of a social system learn about an innovation and go through the "innovation decision process" (Rogers, 2003). Thereby, *"an individual (or other decision-making unit) passes from first knowledge of an innovation, to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision"* (Rogers, 2003, p. 20). The innovation adoption process has been widely described as comprising different,

successive stages, although the number of stages, their precise definition, and their naming vary according to the authors. For the purpose of our study, we drew on the model developed by Beal and Bohlen (1957), which *"comprises five distinct stages of innovation adoption from the point of view of an individual organization: At the **awareness stage**, agents become aware of some new idea, but lack details concerning it. At the **interest stage**, they are seeking more information about the idea, and at the **evaluation stage**, they make a mental trial of the idea by applying the information obtained in the previous stage on their own situation. At the **trial stage**, they apply the idea in a small-scale experimental setting, and if they decide afterwards in favor of a large-scale or continuous implementation of the idea, they have reached the **adoption stage**"* (Estermann, 2016a).

	"Adoption"	**"Advanced implementation"**
Open data	• More than 10% of metadata (average of all metadata types) are available as open data at present, and within the next 5 years over 10 additional percent will be made available as open data.	• More than 50% of metadata (average of all metadata types) and more than 50% of the institution's catalogues, inventories, and finding aids are presently available as open data.
Linked data	• More than 10% of metadata (average of all metadata types) are available as linked data at present, and within the next 5 years over 10 additional percent will be made available as linked data.	• More than 50% of metadata (average of all metadata types) and more than 50% of the institution's catalogues, inventories, and finding aids are presently available as linked data.
Digitization	• More than 10% of content have already been digitized, and within the next 5 years over 5 additional percent will be digitized. OR • More than 5% of content have already been digitized, and within the next 5 years over 10 additional percent will be digitized.	• More than 50% of content have already been digitized.
Open content	• More than 10% of content have already been made available as open content, and within the next 5 years, over 5 additional percent will be made available as open content. OR • More than 5% of content have already been made available as open content, and within the next 5 years, over 10 additional percent will be made available as open content.	• More than 50% of content have already been made available as open content.
Social media	• At least one type of social media is being used at present, and within the next year at least one more will be used. OR • At least two types of social media are being used at present, and within the next year the number of social media types being used remains stable or increases.	• More than 3 (out of 10) different types of social media are being used at present.
Crowdsourcing / collaborative content creation	• At least one type of crowdsourcing or collaborative content creation is being used at present, and within the next year at least one more will be used. OR • At least two types of crowdsourcing or collaborative content creation are being used at present, and within the next year the number of different types being used remains stable or increases.	• More than 2 (out of 5) different types of crowdsourcing or collaborative content creation are being used at present.

Table 1: Criteria used for the "adoption" and the "advanced implementation" stage (Estermann, 2015)

In order to establish the development path followed by heritage institutions when adopting Internet-related practices, we first identified relevant practices based on the existing literature and by consulting both heritage professionals and OpenGLAM activists. The focus was on practices that were expected to be common to all types of heritage institutions (libraries, archives and museums). The questionnaire of our survey was then designed in a way to allow for the responding institutions to be assigned to the different stages of the innovation-decision process as suggested by innovation diffusion theory for each of these practices separately. Thereby, the following criteria were taken into account (Estermann 2015): By default, institutions were assigned to the "no interest" stage. Institutions which indicated that they require further information, training, or external consulting in a given area were assigned at least to the "interest" stage. Institutions which anticipate a minimal level of activity in a given area (e.g. at least 0.5% of content released as open content over the coming 5 years or at least one social media type used over the coming year) were assigned at least to the "evaluation" stage. Institutions which already reported this minimal level of activity today were assigned at least to the "trial stage". Institutions which reported already quite a high level of activity in a given area were assigned either to the "adoption" or to the "advanced implementation" stage (see table 1 for the criteria that were applied). In addition, institutions which showed stagnating or decreasing levels of activity, were assigned to the "stagnation / discontinuance" stage in order to capture those which are planning to abandon or to significantly reduce a given practice. As this latter group is very small (ranging from 0% to 2.1% depending on the practice), it was excluded from further analyses.

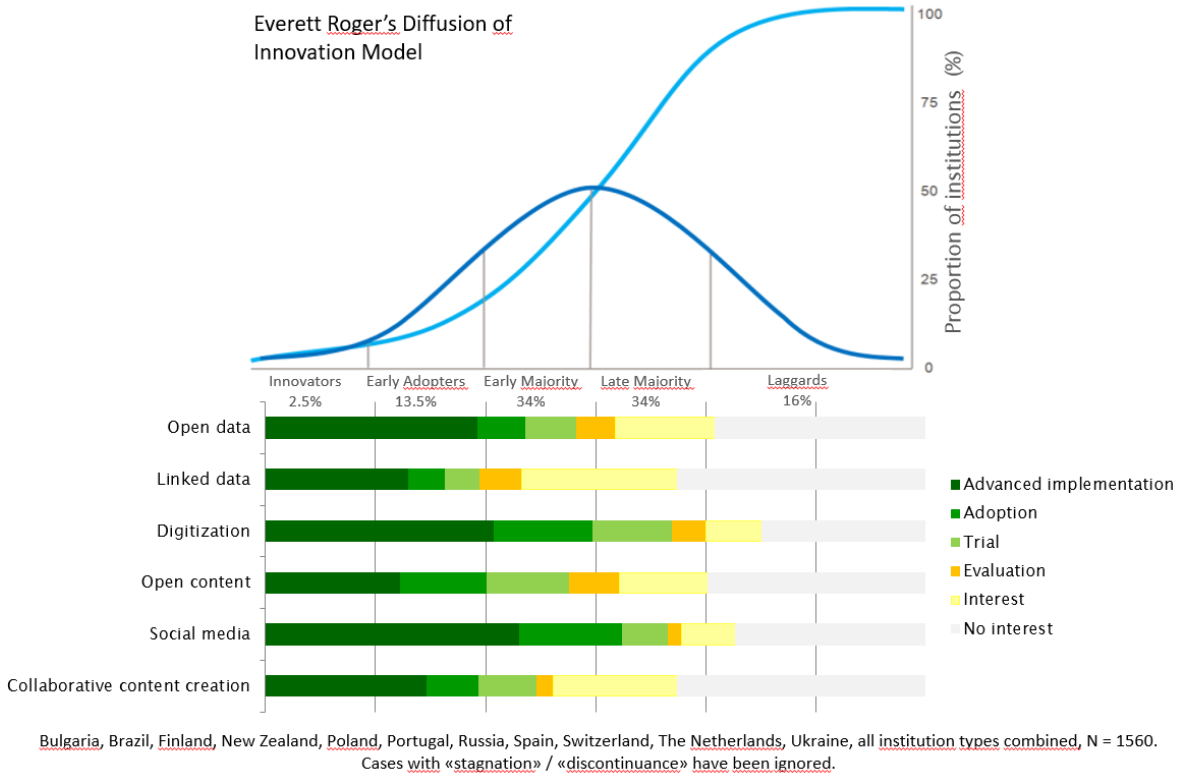


Fig. 1: Diffusion of Internet-related practices among heritage institutions

Figure 1 shows the present state of the diffusion of the various Internet-related practices within the heritage sector. The upper section of the figure features the innovation diffusion model with the different proportions of innovation adopter types ("innovators", "early adopters", "early majority", "later majority", and "laggards"). It has been established through empirical research in many different fields that the adoption of innovations usually follows a normal distribution curve (Rogers, 2003): At the beginning, only few institutions adopt an innovation and diffusion is slow. Once a critical mass of agents has been reached, the pace of diffusion accelerates until it reaches around half of the agents susceptible to adopt the innovation. After that the pace of diffusion slows down again, and it takes quite a long time until the last institutions join the bandwagon (according to the model, the first 16% and the last 16% of institutions each take as long to adopt a given practice as the two thirds of institutions that adopt the practice in the middle of the diffusion process). This non-linear model of innovation diffusion provides the scale for the lower section of the figure which shows for each Internet-related practice the proportion of institutions that are in the various innovation adoption stages. As can be seen in the graphic, at the time of data collection, the use of social media was the most widespread practice with an adoption rate of 61%, followed by digitization (46%), open data (29%), open content (18%), crowdsourcing or collaborative content creation (14%), and linked data (10%).

Note that the speed of innovation diffusion is not necessarily the same for all practices under consideration. Therefore, the order of advancement of the various practices in terms of the innovation diffusion model may differ over time.

While the order of the innovation adoption stages is undisputed, the exact thresholds between the successive stages have been set somewhat arbitrarily based on criteria for which data could be gathered through a quantitative survey. This is also true with regard to the criteria used to distinguish the "adoption" stage and the "advanced implementation" stage (table 1). The assessment is purely quantitative and does not take into account qualitative aspects, such as the success in using different types of social media (in practice, one well-used social media type is certainly better than two poorly used ones). Also, it does not take into account differences between the institutions with regard to the initial situation (some institutions may mainly have public domain material in their holdings, while others may face considerable copyright-related obstacles when it comes to making digital content available on the Internet). Another qualitative difference that is eclipsed by the model concerns the purpose for which social media is used. As has been noted in the literature, the way social media is used by governments or heritage institutions varies a lot – ranging from one-way communication to more participative approaches. By analyzing the various purposes of social media use by means of principal component analysis, we found the following pattern (the categories are not mutually exclusive): 50% of all institutions use social media to reach out to new users and to improve the visibility of the institution, 27% use social media with the intention to give users a more active role, while 20% of institutions use social media to tap into resources (financial resources or know-how) and to foster networking among institutions and users.

4.3. Identification of the development paths

To tackle our research questions with regard to the development path among heritage institutions when it comes to adopting Internet-related practices, we carried out a multinomial logistic regression analysis (Rodríguez, 2007), using SPSS. To do so, we broke the adoption process for the various practices down into three stages ("no interest / interest"; "evaluation / trial"; and "adoption / advanced implementation") and examined the effect of the various independent variables for each of the two steps. Our final model contained nine independent variables relating to an institution's characteristics, such as the type of institution, the most characteristic types of heritage objects in its holdings, its main users, its geographical reach, the number of employees and volunteers, the composition of revenue sources, the percentage of volunteers in its work force, and the institution's legal form. We also included three independent

variables relating to staff skills, such as the number of different ways used to acquire new skills, the overall satisfaction with the skills level, as well as the institution's perceived effectiveness of skills acquisition.

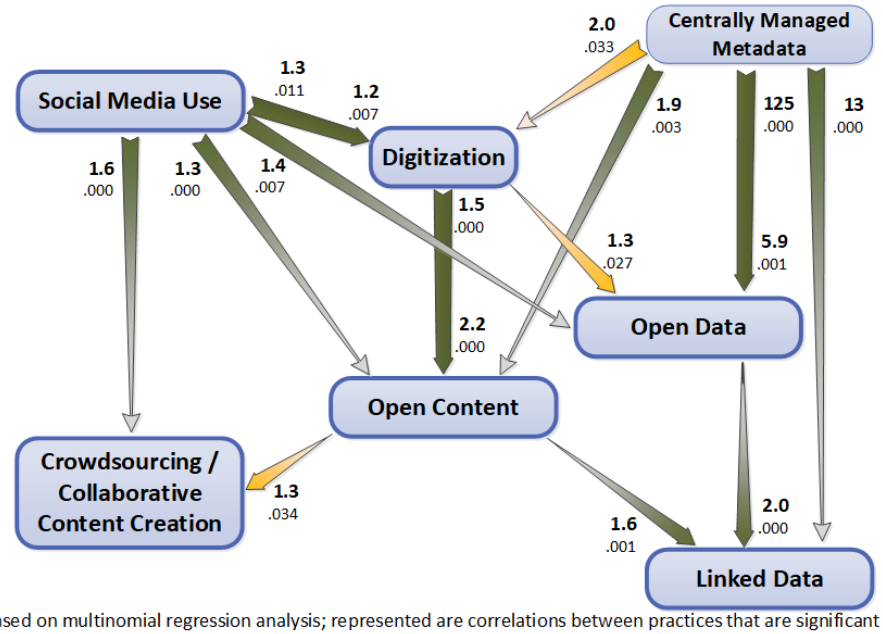
In order to analyze the dependencies between the different practices, the adoption rates of the practices that were more widespread than the practice under consideration were introduced into the model as dependent variables. By this means it is possible to establish to what extent practices tend to constitute a prerequisite in view of the adoption of other, presently less widespread practices. To complement the analysis of interdependencies between various practices, we treated the question whether or not an institution has centrally managed metadata, as an additional practice that was entered as an independent variable into the regression models for all the six other practices.

To control for country differences, we introduced three country-level context factors as further independent variables into our models. After considering several macro-level indicators, we finally settled for the GDP, and the E-Participation Index (EPI), which turned out to be sufficiently independent from each other and promised some explanatory power given the distribution of their values across the countries under consideration. Note that the GDP is strongly correlated with and can therefore serve as a proxy for the ICT Development Index (IDI) and the Human Development Index (HDI). The third context factor introduced in the regression models was the overall effectiveness of skills acquisition by the heritage institutions of a given country, as it appears from the survey data. The choice of this variable is justified by the prominent role of know-how and skills as important factors accelerating the innovation adoption process according to innovation diffusion research (Rogers, 2003). Interestingly, this variable is quite strongly (negatively) correlated with a country's GDP; however, when testing for multicollinearity issues, it turned out that VIF values were relatively small (below 10), indicating that it was acceptable to use both variables in the same regression model.

There were no collinearity issues, and the final models statistically significantly predicted the dependent variables over and above the intercept-only models, with very good results for all models (with p-values below .001). The Nagelkerke pseudo R-square statistics, which gives an indication of the proportion of variance that can be explained by the models, was 0.392 for the "social media use" adoption model (N = 776), 0.356 for "digitization" (N = 767), 0.684 for "open data" (N = 759), 0.371 for "open content" (N = 744), 0.300 for "collaborative content creation" (N = 744), and 0.389 for 'linked data' (N = 740). As missing values were not substituted, the effective sample size varies for each analysis.

5. Results

Figure 2 gives an overview of the results from the multinomial regression analysis. The shape of the arrows indicates whether a correlation holds for the first, the second, or both phases of the adoption process. The exponentiated correlation coefficients indicate the strength of the correlations. Thus, keeping in mind that for the innovation adoption levels a 3-point scale was used ("no interest/interest"; "evaluation/trial"; "adoption/advanced implementation), the graphic can be read as follows:



Results based on multinomial regression analysis; represented are correlations between practices that are significant at 0.01 (green) and at 0.05 (orange). The shape of the arrows indicates whether a correlation holds for the first, the second, or both phases of the adoption process. Exponentiated correlation coefficients are given in bold; the number below them indicates the significance level of the correlation. Correlations with the institutions' characteristics and with context factors are not shown.

Fig. 2: Interrelations between the adoption of various Internet-related practices

- For institutions ranking one step higher on the "social media" adoption scale, the odds of being at the "evaluation/trial" stage instead of the "no interest/interest" stage for "crowdsourcing / collaborative content creation" were 1.6 times higher than for their counterparts ranking one step lower. No significant correlation was however found between social media and the second phase of the innovation adoption process (i.e. moving from "evaluation/trial" to "adoption/advanced implementation). Hence the narrowing arrow in the graphic linking "social media use" to "crowdsourcing / collaborative content creation".
- For the institutions having centrally managed metadata, the odds of being at the "evaluation/trial" stage instead of the "no interest/interest" stage of "open data" adoption were found to be 125 times higher than for their counterparts without centrally

managed metadata. Similarly, their odds of having fully adopted "open data" instead of being at the "evaluation/trial" stage are 5.9 times higher. Hence the broad arrow from the beginning to the end.

- In contrast, ranking a point higher on the "open data" adoption scale does not imply that institutions are more likely to evaluate and try "linked open data"; they are however twice as likely to be among the institutions fully adopting "linked data" than their counterparts which rank a point lower on the "open data" adoption scale. Hence the broadening arrow.

Note that for "centrally managed metadata" a binary variable was used instead of the 3-point adoption scales used for the other practices. The corresponding values therefore tend to be higher and are not directly comparable to the others.

Correlations that are significant at the 0.01 level are represented in green, correlations that are significant only at the 0.05 level are shown in orange. Significance levels are indicated below the exponentiated correlation coefficients. Correlations with the institutions' characteristics and with context factors are not shown in the figure. These factors were however controlled for in the model.

5.1. Typical path when adopting internet-related practices (RQ 1)

It appears from the data that the existence of centrally managed metadata (e.g. in the form of catalogues, inventories, or finding aids) plays an important role with regard to the adoption of "open data" as well as to the initiation of the adoption processes of "digitization", "open content", and "linked data". It is interesting to note that 37% of institutions do not have such centrally managed metadata.

Many dependencies have been identified between the different Internet-related practices. Thus, the adoption of "social media use" tends to precede the adoption of "digitization", even though historically, coordinated efforts to digitize heritage collections preceded the advent of social media. Furthermore, the adoption of "social media use" plays a role with regard to the initiation of the adoption processes of "open data", "open content", and "crowdsourcing / collaborative content creation". "Digitization" rather unsurprisingly appears as a prerequisite of "open content". At the same time, it seems to facilitate full adoption of "open data", which in turn facilitates full adoption of "linked data". And finally, institutions who have adopted "open content" are more likely to also fully adopt "crowdsourcing / collaborative content creation" and "linked data". Given these results, we can conclude that there is not one single typical path

heritage institutions follow when adopting the practices under examination, but several inter-connected paths. Note that no significant differences were found between public institutions and private nonprofits when it comes to the adoption of the different practices (profit-oriented companies were excluded from the analysis as they are rather rare among heritage institutions and represent only 1% of the sample).

5.2. Validity of the Lee & Kwak Model and Tim Berners-Lee's 5-star model (RQ 2)

When putting the various OpenGLAM-related trends into perspective, it appears that the unidimensional nature of the Lee & Kwak "Open Government Implementation Model" is not supported by the data. Most notably, Lee's and Kwak's postulation that the opening up of data should come before the extensive use of social media, does not hold in the face of the empirical evidence – at least not in the heritage sector, where the use of social media was even found to play a role in triggering the adoption of "open data" and "open content". Based on our findings, a more nuanced picture can be painted with heritage institutions following several, inter-connected paths when implementing OpenGLAM-related practices: The first one leads from social media use to crowdsourcing or collaborative content creation. The second one leads from social media use and centrally managed metadata through digitization to open content, while the third path leads from centrally managed metadata through open data to linked data. Implementation of open data appears to be a prerequisite for sustained implementation of linked data, meaning that linked data in the heritage sector is mainly about linked *open* data. The data thus supports the validity of Tim Berners-Lee's five-star model of open data maturity.

6. Discussion

While e-government maturity models have been criticized for various reasons, the validity of the stages identified through a synthesis of the first-generation stage models has been widely established by empirical research. It should however be kept in mind that the models describe a development trend rather than a must-go-path, and that there is no empirical evidence suggesting that the stages correspond to discrete phases in e-government development. On the contrary, e-government adoption is incremental, which is in line with the way innovation diffusion theory conceives of the innovation adoption process. The first-generation e-government stage models have received a lot of criticism due to the speculative nature of the predicted latter stages of e-government development. However, as we have shown in the present article, taken together, the various models anticipated the actual developments in the field of e-government quite well. This is in particular true with regard to the following aspects:

- Data and information are being shared between various government agencies and processes are designed to cut through organizational silos to provide seamless services to users (Wescott, 2001; Moon, 2002; Windley, 2002; Alhomod & Shafi, 2012): Apart from the creation of integrated library catalogues and access platforms (not covered by the present study), data sharing and integration in the heritage sector is mainly achieved by means of open and linked data.
- Data sharing is extended beyond the public sector, and private sector companies are involved in the provision of seamless services to citizens (Andersen & Henriksen, 2006): While the heritage sector has always been constituted by a mix of public and private institutions, new community-driven services, such as the free online encyclopedia Wikipedia with its online collaborative approach represents a new form of service provision that heavily relies on heritage data from a myriad of institutions.
- Data ownership is transferred to customers (Andersen & Henriksen, 2006): Heritage institutions de facto transfer ownership of digital heritage to the public by respecting the public domain and by releasing some of their content under free licenses.
- A user-centered perspective is adopted (Deloitte Consulting & Deloitte & Touche, 2000; Baum & Di Maio, 2000; Baum & Di Maio, 2000; Windley, 2002; Rohleder & Jupp, 2003; West, 2004; Andersen & Henriksen, 2006; Klievink & Janssen, 2009; Lorincz et al, 2009): Some of the social media use by heritage institutions is indeed motivated by a strive for a more partner-like relationship to their users. User-centered design is also one of the main drivers behind data integration across institutional silos.
- Citizen participation is being enabled (Hiller & Bélanger, 2001; Wescott, 2001; Moon, 2002; Netchaeva, 2002; West, 2004; Shahkooh et al., 2008; Almazan & Gil-Garcia, 2008; UN, 2012): Crowdsourcing and online collaboration have been integrated into the repertoire of many heritage institutions.
- The prevalent division between inside and outside the governmental organization is being overcome, leading to enhanced accountability and transparent processes (Andersen & Henriksen, 2006): By means of online collaborative projects, heritage institutions increasingly work hand in hand with online communities, thereby involving "outsiders" in processes that traditionally were carried out inside the institution with little public scrutiny.

A couple of trends that have been predicted in some of the e-government development models have not been covered by the study. This is notably true for the aspect of enhanced participation in political decision making (Hiller & Bélanger, 2001; Wescott, 2001; Netchaeva, 2002; Moon,

2002; Siau & Long, 2005; Lee, 2010; UN, 2012). While it could be argued that some of the participatory approaches used in the heritage sector give the public a say in organizational decision-making, this mainly applies to the operative level and would not be considered "public participation" in the sense of Rowe and Frewer's definition as *"the practice of involving members of the public in the agenda-setting, decision-making, and policy-forming activities of organizations/institutions responsible for policy development"* (Rowe & Frewer, 2005). As a matter of fact, one would usually not think of heritage institutions as institutions responsible for policy development, even though a few of them may play an important role in defining what a society's documented memory is supposed to comprise. Similarly, the study has not covered the aspect of data portability regarding personal data implied by the predictions made by Andersen & Henriksen (2006). Here again, other spheres of the public sector, such as health care, may present more obvious use cases for portable personal data than the heritage sector.

As with the earlier stages of e-government development, there is a strong need to carry out empirical research to establish the validity of the models and to gauge the pace of actual progress with regard to the adoption of innovative practices. Compared to the methods employed by some of the early empirical tests of the first-generation stage models, the theoretical lens provided by innovation diffusion theory is particularly well suited to detect new trends in their early stages (e.g. the adoption of linked data in our case). This is important in order to avoid the false rejection of projections due to early measurement – as exemplified by Norris & Reddick (2013), who overturned some of the conclusions drawn by an earlier, similar study (Coursey & Norris, 2008).

6.1. Usefulness and limitations of stage models

The use of maturity models for sense-making and leading change in the field of e-government has a two-decade-long tradition. While maturity models are no panacea and certainly do not cover all the needs of change management, they are a useful tool to spur reflection within organizations about ongoing transformation processes and to help them shape a changing environment. It is in this vein that we have successfully used the model presented in this article in our own consulting practice. The fact that the model is backed up by quantitative empirical data helps striking a balance between the technical optimism which may arise when extrapolating from the outstanding examples of a few first-mover institutions on one hand, and the overly critical pessimism displayed by some researchers and observers on the other hand. As has been demonstrated by various authors, the value of stage models can be enhanced if they are coupled with reflections on the capabilities needed by organizations to evolve from one

stage to the other (Klievink & Janssen, 2009; Kim & Grant, 2010; Chen et al., 2011) or if they are accompanied by a discussion of their implications regarding business-IT alignment (Davison et al., 2005). Particularly relevant is the observation made by Klievink & Janssen (2009) that organizations may reach certain development stages only through inter-organizational collaboration. While this observation is true for the integration stage of e-government development, it is equally true for the institutions' engagement in online collaborative communities and for their deployment of linked open data. Analyzing this issue by means of atomic business models as suggested by Janssen, Kuk, and Wagenaar (2008) and Estermann et al. (2009) may be particularly useful.

The approach preconized in this paper rests on the assumption that the development model of e-government is evolutionary, and that this evolution is driven by the interplay between technological advancements and evolving social practices. As has been shown for the adoption of social media compared to digitization, certain innovative practices are adopted more quickly than others, which leaves the possibility that certain more recent practices are today more widespread than others that have made their first appearances much earlier. Also, stages-of-growth are not as absolute and clear-cut as some of the earlier e-government maturity models suggest: The deployment of e-government may follow varying development paths for different institutions and for different time frames. By empirically grounding the model based on the theoretical framework of innovation diffusion theory, these variations can be accounted for. When interpreting the data, several caveats apply: Not every phenomenon is easily measurable, and the various measurement methods (e.g. self-reporting versus third party inspection of government websites) have their strengths, weaknesses, and blind spots. Conclusions should therefore not be drawn too hastily, and special care should be applied when using such measurements for public benchmarking.

6.2. Government transformation

Our findings suggest that the transformative processes anticipated by different generations of e-government stage models are well at work within the heritage sector, leading to increasingly integrated services, participative approaches and an emerging collaborative culture, accompanied by a shift in the way data are perceived and managed – a shift characterized by the break-up of proprietary data silos and their replacement by a commonly shared data infrastructure allowing data to be freely shared, inter-linked and re-used. It can thus be concluded that we have well arrived in the post-managerial era, with later stages of e-

government development deviating from the NPM agenda in a number of points (cf. Dunleavy et al., 2006):

- There is an increased focus on the role of networks and on collaborative governance in place of the NPM focus on market exchange. While NPM supported contracting out conventional governmental missions to private companies or non-profit organizations, citizen engagement draws on the collective knowledge of the public (Nam, 2012).
- Government is increasingly taking on the role of a platform, providing free access to data and services for others to exploit as they see fit. This idea of providing infrastructure resources under an open access regime is in stark contrast to the NPM call on governments to monetize their services by charging fees.
- Citizens are increasingly seen as prosumers and collaborators instead of customers as was the case under the NPM agenda (Abdelsalam et al, 2013). Together with the increased focus on collaboration between public and private sector organizations, this shift away from the marketization of public services leads to increased permeability of organizational boundaries. When many institutions and private individuals contribute to collaborative projects such as Wikipedia or Wikidata, organizational boundaries are transcended altogether (Estermann et al., 2009).
- As far as the focus is on providing infrastructure resources for the digital society, the distribution of roles between the private and the public sectors is reversed. While the NPM model preconized a public sector that looks for best practices within the business sector, the focus on providing data and data-related services as infrastructure resources brings the public sector back into play due to its traditional role in providing key infrastructures and its focus on creating public value.

As with the implementation of earlier stages of e-government development, these transformative changes will take time. Like the research on earlier phases of e-government development (e.g. West, 2004), our data does not suggest a sudden shift from one paradigm to the other.

6.3. Three development paths of open government

The model derived from our empirical data calls into question the unidimensional nature of the Lee & Kwak Open Government Maturity Model. Instead, open government appears to evolve along three inter-connected development paths. It remains to be seen to what extent these three paths converge in the future as heritage institutions increasingly embrace Wikidata (combining

collaborative content creation with linked data) and implement the IIIF[2] standard (applying approaches akin to linked data to the realm of content, cf. Loh, 2017). Similarly, future will tell whether collaborative content creation and linked data will remain associated to open data and open communities, or whether we will see an increased deployment of such approaches behind access controls and within closed communities, as governments, research and heritage institutions increasingly leverage these approaches in the context of sensitive data and copyrighted content.

7. Conclusion

By positing that e-government typically evolves through a set of stages in a precise order, e-government stage models imply that there is a 'natural' development path institutions should follow in their evolution towards 'higher' stages of e-government. As stage models are used to guide institutions' change processes and to evaluate progress, it is important to make sure that the order of stages is empirically valid. While there is empirical evidence for the earlier stages of e-government development, such as "online presence", "interactivity", and "transaction", little empirical research has been presented with regard to the later stages of e-government development and notably so for the innovations associated with the current public-sector transformation, described as a trend towards "open government". To close this gap, we have put two existing development models to the test and have attempted to identify the typical path heritage institutions follow when implementing some of the more recent Internet-related practices. In the process, a new stage-of-growth model for e-government has been developed, which is empirically grounded and allows for varying development paths. Unlike earlier models, the proposed model is based on innovation diffusion theory and allows to empirically evaluate new trends at a relatively early stage.

While our model rests on a broad empirical basis and holds for a variety of countries, its validity beyond the heritage sector still needs to be established by similar research in the field of classical public administration and in other areas of public sector activity, such as health care, education, or research. Further research is also needed in order to test predictions with regard to the increased adoption of participative approaches in the field of political decision making, as predicted by some of the first-generation e-government stage models, as this aspect has not been covered by the present study.

[2] The International Image Interoperability Framework (IIIF) defines several application programming interfaces that provide a standardized method of describing and delivering images over the web, as well as metadata about structured sequences of images. It ensures the interoperability between content repositories and viewer applications. The standard is presently extended to cover also audio-visual content.

8. Acknowledgements

I would like to thank all the lovely people who have made my research about the heritage sector possible by supporting it in one or the other manner: The members of the OpenGLAM Working Group of the Open Knowledge Foundation: Joris Pekel, Maarten Brinkerink, Dorota Kawęcka, Sanna Mattila, Helene Hahn, Thomasin Sleigh, Lieke Ploeger, Subhashish Panigrahi, and Mariana Valente, for helping to get the project started and to implement it in their respective countries. All the other people who provided feedback during the development of the questionnaire: Gemma Echevarria, Maria de Vallibana Serrano, Merete Sanderhoff, Laura Sillanpää, Gerhard Jan Nauta, Max Hammond, Laura Carletti, Alek Tarkowski, Liliana Melgar. The people who helped translating the questionnaire: Joris Pekel, and Erwin Verbruggen (Dutch); Laura Sillanpää, Katja Bargum, Pia Lonardi, Antti Pakarinen, Tove Ørsted, and Maria Virtanen (Finnish); Léonard Kwuida and Frédéric Noyer (French); Helene Hahn and Sylvia Petrovic-Majer (German); Dorota Kawęcka, Aleksandra Janus, and Anna Buchner (Polish); Vladislav Nedelev and colleagues (Bulgarian); Maria Valente and colleagues (Brazilian Portuguese); Helena Patrício, Margarida Lopes, and Dulce Fontes (adaptation to European Portuguese), Anna Khrobolova, Bohdan Melnychuk, Ekaterina Estermann, and Vadim Zaytsev (Russian), as well as Anna Khrobolova, Vira Motorko, Bohdan Melnychuk, Oksana Brui, and Galyna Onysko (Ukrainian). And last, but not least the national teams in the various countries who helped rolling out the survey.

As regards the present article, I am grateful to my thesis supervisor, Reto Steiner, as well as to Claire Kaiser and Alessia Neuroni for their helpful comments. My special thanks go to Marijn Janssen, who's support was instrumental in adapting the article for the e-government research community, as well to three anonymous reviewers, whose well-founded remarks helped me to give the article the final touch.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

The survey data, along with the questionnaire and the detailed results of the regression analyses presented in this article, are available on: http://survey.openglam.ch

9. Vita

Beat Estermann is the head of the research unit Open & Linked Data at the Bern University of Applied Sciences' E-Government Institute. He holds master's degrees in translation studies and in public management, both from the University of Geneva. After working as a research assistant for the Service for Educational Research of the Canton of Geneva, he joined the E-Government Institute in 2007 where he has been conducting research projects and carried out consulting activities for public sector organizations. His main research focus is on issues surrounding the digitization of society. Since 2014, he has been coordinating the OpenGLAM working group of the Opendata.ch association, whose goal is to promote open data among heritage institutions. Since 2015 he has also been an active member of the eCH Specialized Group "Open Government Data", which deals with standardization issues in the area of open government data; from its inception in 2015 until 2018 he has been leading the specialized group.

REFERENCES

Abdelsalam, H. M., Reddick, C. G., Gamal, S., & Al-Shaar, A. (2013). Social media in Egyptian government websites: Presence, usage, and effectiveness. *Gov. Inf. Q.*, *30*(4), 406-416.

Alhomod, S. M., & Shafi (2012). Best practices in E government: A review of some Innovative models proposed in different countries. *International J. of Electrical & Computer Sciences*, *12*(1), 1-6.

Almazan, R. S., & Gil-García, J. R. (2008). E-Government portals in Mexico. In *Electronic Gov.: Concepts, Methodologies, Tools, and Applications* (pp. 1726-1734). IGI Global.

Andersen, K. V., & Henriksen, H. Z. (2006). E-government maturity models: Extension of the Layne and Lee model. *Gov. Inf. Q.*, *23*(2), 236-248.

Andersen, K. N., Medaglia, R., Vatrapu, R., Henriksen, H. Z., & Gauld, R. (2011). The forgotten promise of e-government maturity: Assessing responsiveness in the digital public sector. *Gov. Inf. Q.*, *28*(4), 439-445.

Bannister, F. (2007). The curse of the benchmark: an assessment of the validity and value of e-government comparisons. *International Review of Administrative Sciences*, *73*(2), 171-188.

Baum, C., & Di Maio, A. (2000). Gartner's four phases of e-government model. *Gartner Group*.

Beal, G.M. & Bohlen, J. M. (1957). *Special Report No. 18*, Agriculture Extension Service, Iowa State College, 1, pp. 56–77, 1957. Reprinted in 1981.

Bellamy, C., & Taylor, J. A. (1998). *Governing in the information age*. Open University Press.

Benkler, Y. (2004). "Sharing nicely: On shareable goods and the emergence of sharing as a modality of economic production," *Yale Law J.*, 273-358.

Bekkers, V. (2013). "E-government and innovation: the socio-political shaping of ICT as a source of innovation". In: Osborne, S. P., and Brown, L. (eds.) (2013). *Handbook of innovation in public services*. Edward Elgar Publishing.

Bekkers, V., & Homburg, V. (2007). The myths of e-government: Looking beyond the assumptions of a new and better government. *The Inf. Society*, *23*(5), 373-382.

Berners-Lee, T. (2006-2009). Linked data - design issues. Retrieved from: http://www.w3.org/DesignIssues/LinkedData.html (20 March 2018).

Bizer, C., Heath, T, & Berners-Lee, T. (2009). Linked data - the story so far. Semantic services, interoperability and web applications: emerging concepts, 205-227.

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Gov. Inf. Q.*, *29*, 123–132.

Brainard, L. A., & McNutt, J. G. (2010). Virtual government–citizen relations: Informational, transactional, or collaborative? *Administration & Society*, *42*(7), 836-858.

Cagnazzo, L. (2017). *Linked Data: Implementation, Use, and Perceptions across European National Libraries* (Doctoral dissertation, University of Strathclyde, Glasgow, UK).

Capriotti, P. & Pardo Kuklinski, H. (2012). "Assessing dialogic communication through the Internet in Spanish museums," *Public Relations Rev.*, *38*(4), 619-626.

Chadwick, A., & May, C. (2003). Interaction between States and Citizens in the Age of the Internet: "e-Government" in the United States, Britain, and the European Union. *Governance*, *16*(2), 271-300.

Chen, J., Yan, Y., & Mingins, C. (2011, November). A three-dimensional model for e-government development with cases in China's regional e-government practice and experience. In: *Management of e-Commerce and e-Government (ICMeCG), 2011 International Conference on* (pp. 113-120). IEEE.

Chun, S. A., Shulman, S., Sandoval, R., & Hovy, E. (2010). "Government 2.0: Making connections between citizens, data and government". *Inf. Polity*, *15*(1), 1.

Concha, G., Astudillo, H., Porrua, M., & Pimenta, C. (2012). E-Government procurement observatory, maturity model and early measurements. *Gov. Inf. Q.*, *29*, S43-S50.

Coursey, D., & Norris, D. F. (2008). Models of e-government: Are they correct? An empirical assessment. *Public Administration Rev.*, *68*(3), 523-536.

Davison, R. M., Wagner, C., & Ma, L. C. (2005). From government to e-government: a transition model. *Inf. Technology & People*, *18*(3), 280-299.

DeBrí, F., & Bannister, F. (2015, January). E-government stage models: A contextual critique. In *System Sciences (HICSS), 2015 48th Hawaii International Conference on* (pp. 2222-2231). IEEE.

Deloitte Consulting & Deloitte & Touche (2000). *At the dawn of e-Government: the citizen as customer*. Deloitte Consulting, New York.

Dunleavy, P., & Hood, C. (1994). From old public administration to new public management. *Public money & management*, *14*(3), 9-16.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New public management is dead—long live digital-era governance. *J. of Public Administration Res. and Theory*, *16*(3), 467-494.

Edelstein, J., Galla, L., Li-Madeo, C., Marden, J., Rhonemus, A., & Whysel, N. (2013). Linked open data for cultural heritage: evolution of an information technology. In *Proc. of the 31st ACM International Conference on Design of Communication* (pp. 107-112). ACM.

Estellés-Arolas, E. & González-Ladrón-de-Guevara, F. (2012). "Towards an integrated crowdsourcing definition," *J. of Inf. Science*, *38*(2), pp. 189-200.

Estermann, B., Riedl, R., & Neuroni, A. C. (2009). "Integrated and transcendent e-government: keys for analyzing organizational structure and governance". In: *Proc. of the 10th Annual International Conference on Digital Gov. Res.: Social Networks: Making Connections between Citizens, Data and Government*, pp. 162-171.

Estermann, B., Fraefel, M., Neuroni, A. C., & Vogel, J. (2016). Conceptualizing a national data infrastructure for Switzerland. *Information Polity*, (Preprint), 1-23.

Estermann, B. (2013). Swiss Heritage Institutions in the Internet Era. Results of a pilot survey on open data and crowdsourcing. Bern University of Applied Sciences, E-Government Institute.

Estermann, B. (2014). "Diffusion of Open Data and Crowdsourcing among Heritage Institutions: Results of a Pilot Survey in Switzerland," *J. of Theoretical and Applied Electronic Commerce Res.*, Vol 9, Issue 3, September 2014, pp. 15-31.

Estermann, Beat (2015). Diffusion of Open Data and Crowdsourcing among Heritage Institutions. Based on data from Finland, Poland, Switzerland, and The Netherlands. Paper Presented at the EGPA 2015 Conference, held on 26-28 August 2015 in Toulouse, France.

Estermann, Beat (2016a). OpenGLAM Benchmark Survey – Measuring the Advancement of Open Data / Open Content in the Heritage Sector. Proceedings of the International Symposium on the Measurement of Digital Cultural Products, 9-11 May 2016, Montreal, Canada.

Estermann, Beat (2016b). "OpenGLAM" in Practice – How Heritage Institutions Appropriate the Notion of Openness. Paper presented at the IRSPM 2016 Conference in Hong Kong.

Fath-Allah, A., Cheikhi, L., Al-Qutaish, R. E., & Idri, A. (2014). E-government maturity models: A comparative study. *International J. of Softw. Engineering & Applications*, *5*(3), 71.

Fountain, J. E. (2004). *Building the virtual state: Information technology and institutional change*. Brookings Institution Press.

Gil-Garcia, J. R., & Martinez-Moyano, I. J. (2007). Understanding the evolution of e-government: The influence of systems of rules on public sector dynamics. *Government Information Quarterly*, *24*(2), 266-290.

Gottschalk, P. (2009). Maturity levels for interoperability in digital government. *Gov. Inf. Q.*, *26*(1), 75-81.

Grant, G., & Chau, D. (2005). Developing a Generic Framework for E-Government. *Journal of Global Information Management*, *13*(1), 1.

Gronemann, S. T., Kristiansen, E., & Drotner, K. (2015). „Mediated co-construction of museums and audiences on Facebook," *Museum Management and Curatorship*, *30*(3), 174-190.

Grönlund, Å. (2010, August). Ten years of e-government: The 'end of history'and new beginning. In *International Conference on Electronic Government* (pp. 13-24). Springer, Berlin, Heidelberg.

Hammack, D. C. (1989). Private organizations, public purposes: Nonprofits and their archives. *The J. of American History*, *76*(1), 181-191.

Hand, L. C., & Ching, B. D. (2011). " You Have One Friend Request" An Exploration of Power and Citizen Engagement in Local Governments' Use of Social Media. *Administrative Theory & Praxis*, *33*(3), 362-382.

Heath, T., & Bizer, C. (2011). Linked Data: Evolving the Web into a Global Data Space. Synthesis Lectures on the Semantic Web: Theory and Technology, 1:1, 1-136, Morgan & Claypool Publishers.

Hiller, J. S., & Bélanger, F. (2001). Privacy strategies for electronic government. *E-gov.*, *200*, 162-198.

Hood, C. (1991). A public management for all seasons?. *Public administration*, *69*(1), 3-19.

Hood, C. (1995). The "New Public Management" in the 1980s: variations on a theme. *Accounting, organizations and society*, *20*(2-3), 93-109.

Holley, R. (2010). "Crowdsourcing: how and why should libraries do it?" *D-Lib Magazine*, *16*(3), 4.

Hsu, C. L., & Park, H. W. (2012). Mapping online social networks of Korean politicians. *Gov. Inf. Q.*, *29*(2), 169-181.

Hughes, O. E. (2003). *Public management and administration*. Palgrave.

Janssen, M., Kuk, G., & Wagenaar, R. W. (2008). A survey of Web-based business models for e-government in the Netherlands. *Gov. Inf. Q.*, *25*(2), 202-220.

Janssen, M., & Van Veenstra, A. F. (2005). Stages of growth in e-government: An architectural approach. *The electronic journal of e-government*, *3*(4), 193-200.

Johnson, P., & Thomas, B. (1998). The economics of museums: a research perspective. *J. of Cultural Economics*, 22(2-3), 75-85.

Kalampokis, E., Tambouris, E., & Tarabanis, K. (2011). Open government data: A stage model. *Electronic government*, 235-246.

Kim, D. Y., & Grant, G. (2010). E-government maturity model using the capability maturity model integration. *J. of Systems and Information Technology*, *12*(3), 230-244.

Klievink, B., & Janssen, M. (2009). Realizing joined-up government—Dynamic capabilities and stage models for transformation. *Gov. Inf. Q.*, *26*(2), 275-284.

Lämmerhirt, D., Rubinstein, M., & Montiel, O. (2017). The State of Open Government Data in 2017. Open Knowledge International. Retrieved from: https://blog.okfn.org/files/2017/06/FinalreportTheStateofOpenGovernmentDatain2017.pdf (20 March 2018).

Layne, K., & Lee, J. (2001). Developing fully functional E-government: A four stage model. *Gov. Inf. Q.*, *18*(2), 122-136.

Lee, G. & Kwak, Y. H. (2012). "An open government maturity model for social media-based public engagement," *Gov. Inf. Q.*, *29*(4), 492-503.

Lee, J. (2010). 10year retrospect on stage models of e-Government: A qualitative meta-synthesis. *Gov. Inf. Q.*, *27*(3), 220-230.

Liew, C. L. (2014). "Participatory Cultural Heritage: A Tale of Two Institutions' Use of Social Media," *D-Lib Magazine*, *20*(3), 1.

Liew, C. L., Wellington, S., Oliver, G., & Perkins, R. (2015). "Social Media in Libraries and Archives: Applied with Caution," *Canadian J. of Inf. and Library Science*, *39*(3), 377-396.

Loh, G. (2017). Linked data and IIIF: Integrating taxonomy management with image annotation. In *Pacific Neighborhood Consortium Annual Conference and Joint Meetings (PNC), 2017* (pp. 50-55). IEEE.

Lorincz, B., Colclough, G., Tinholt, D., van Oranje, C., Cattaneo, G., & Jacquet, L. (2009) Smarter, Faster, Better eGovernment. 8th Benchmark Measurement. European Commission, Directorate General for Information Society and Media. Retrieved from: http://www.mof.gov.cy/mof/DITS/dits.nsf/All/C1B4301D69B229D7C225781700420412/$file/egov_benchmark_20098th.pdf (20 March 2018).

Maheshwari, D., & Janssen, M. (2013). Measurement and benchmarking foundations: Providing support to organizations in their development and growth using dashboards. *Gov. Inf. Q.*, *30*, S83-S93.

Mainka, A., Hartmann, S., Stock, W. G., & Peters, I. (2014). Government and social media: A case study of 31 informational world cities. In *System Sciences (HICSS), 2014 47th Hawaii International Conference on* (pp. 1715-1724). IEEE.

Misuraca, G. C. (2009). e-Government 2015: exploring m-government scenarios, between ICT-driven experiments and citizen-centric implications. *Technology Analysis & Strategic Management*, *21*(3), 407-424.

Moon, M. J. (2002). The evolution of e-government among municipalities: rhetoric or reality? *Public Administration Rev.*, *62*(4), 424-433.

Mossberger, K., Wu, Y., & Crawford, J. (2013). Connecting citizens and local governments? Social media and interactivity in major US cities. *Gov. Inf. Q.*, *30*(4), 351-358.

Nam, T. (2012). Suggesting frameworks of citizen-sourcing via Government 2.0. *Gov. Inf. Q.*, *29*(1), 12-20.

Nauta, G. J., Bakker, S., & de Niet, M. (2011). *ENUMERATE Core Survey 1 Methodology*, November 2011.
Retrieved from: http://www.egmus.eu/fileadmin/ENUMERATE/deliverables/ENUMERATE-D2-04.pdf (30 July 2015).

Netchaeva, I. (2002). E-government and e-democracy: a comparison of opportunities in the north and south. *Gazette (Leiden, Netherlands)*, *64*(5), 467-477.

Ninck, A., Bürki, L., Hungerbuehler, R., & Mühlemann, H. (2014). *Systemics: Viable Solutions for Complex Challenges*. Heuris publishing.

Norris, D. F., & Reddick, C. G. (2013). Local e-government in the United States: Transformation or incremental change? *Public Administration Rev.*, *73*(1), 165-175.

OKFN (2013) *OpenGLAM Principles, version 1.0*, as established by the Open Knowledge Foundation's OpenGLAM Working Group. Retrieved from: http://openglam.org/principles/ (8 March 2016).

Oomen, J. & Aroyo, L. (2011). "Crowdsourcing in the cultural heritage domain: opportunities and challenges". In: *Proc. of the 5th International Conference on Communities and Technologies*, ACM, pp. 138-149.

Pollitt, C. (1995). Justification by works or by faith? Evaluating the new public management. *Evaluation*, *1*(2), 133-154.

Rodríguez, G. (2007). *Lecture Notes on Generalized Linear Models*. Retrieved from: http://data.princeton.edu/wws509/notes/ (20 March 2018).

Rogers, E. M. (2003). *Diffusion of innovations*, Free Press.

Rohleder, S. J., & Jupp, V. (2003). *E-government Leadership: Engaging the customer.* New York, Accenture.

Rowe, G., & Frewer, L. J. (2005). A typology of public engagement mechanisms. *Science, Technology, & Human Values*, *30*(2), 251-290.

Schuster, J. M. (1998). Neither public nor private: the hybridization of museums. *J. of Cultural Economics*, *22*(2-3), 127-150.

Shahkooh, K. A., Saghafi, F., & Abdollahi, A. (2008, April). A proposed model for e-Government maturity. In Information and Communication Technologies: From Theory to Applications, 2008 3rd International Conference on (pp. 1-5). IEEE.

Siau, K., & Long, Y. (2005). Synthesizing e-government stage models–a meta-synthesis based on meta-ethnography approach. *Industrial Management & Data Systems*, *105*(4), 443-458.

Stroeker, N., & Vogels, R. (2014). "Survey Report on Digitization in European Cultural Heritage Institutions 2014", ENUMERATE Project. Retrieved from: http://www.enumerate.eu/fileadmin/ENUMERATE/documents/ENUMERATE-Digitisation-Survey-2014.pdf (30 July 2015).

Strokosch, K. (2013). "Co-production and innovation in public services: can co-production drive innovation?" In: Osborne, S. P. and Brown, L. (eds.) (2013). *Handbook of innovation in public services*. Edward Elgar Publishing.

Torres, L., Pina, V., & Royo, S. (2005). E-government and the transformation of public administrations in EU countries: Beyond NPM or just a second wave of reforms? *Online Information Rev.*, *29*(5), 531-553.

UN & ASPA (2001). Benchmarking E-government: A Global Perspective. - Assessing the Progress of the UN Member States. United Nations Division for Public Economics and Public Administration & American Society for Public Administration.

UN (2003). UN Global E-government Survey 2003. United Nations Department of Economic and Social Affairs (UNDESA).

UN (2004). Global E-Government Readiness Report 2004. Towards Access for Opportunity. United Nations Department of Economic and Social Affairs. UNPAN/2004/11.

UN (2005). Global E-Government Readiness Report 2005. From E-Government to E-Inclusion. United Nations Department of Economic and Social Affairs. UNPAN/2005/14.

UN (2008). UN E-Government Survey 2008. From E-Government to Connected Governance. United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/112.

UN (2012). United Nations E-Government Survey 2012. E-Government for the People. United Nations Department of Economic and Social Affairs. ST/ESA/PAS/SER.E/150.

UN (2014). United Nations E-Government Survey 2014. E-Government for the Future We Want. United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/188.

UN (2016). United Nations E-Government Survey 2016. E-Government in Support of Sustainable Development. United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/205.

Van Veenstra, A. F., Klievink, B., & Janssen, M. (2009). Barriers for transformation: Impediments for transforming the public sector through e-government.

Veljković, N., Bogdanović-Dinić, S., & Stoimenov, L. (2014). Benchmarking open government: An open data perspective. *Gov. Inf. Q.*, *31*(2), 278-290.

Web Foundation (2017). Open Data Barometer Global Report, Fourth Edition, World Wide Web Foundation. Retrieved from: http://opendatabarometer.org/doc/4thEdition/ODB-4thEdition-GlobalReport.pdf (20 March 2018).

Wescott, C. G. (2001). E-Government in the Asia-pacific region. *Asian J. of Political Science*, *9*(2), 1-24.

West, D. M. (2004). E-government and the transformation of service delivery and citizen attitudes. *Public Administration Rev.*, *64*(1), 15-27.

Windley, P. J. (2002). E-government Maturity: An eGovernment maturity model used by the State of Utah.

Yoose, B., & Perkins, J. (2013). The linked open data landscape in libraries and beyond. *J. of Library Metadata*, *13*(2-3), 197-211.

Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. *Gov. Inf. Q.*, *24*(3), 646-665.

2.3 Leading Public Sector Transformation through an Ecosystem Approach

Paper published in Information Polity

Leading Public Sector Transformation through an Ecosystem Approach

Beat Estermann, beat.estermann@estermann-digi.ch

Abstract. The digital transformation has led to fundamental changes in the way public administration operates, calling for a new paradigm in public sector governance. Furthermore, since the early 2000s, attention has been drawn to the appearance of a new form of governance, termed "collaborative governance". In this context, the ecosystem metaphor has increasingly been put forward as a tool for leading change in the public sector and beyond, as it accounts for the interdependency of social, technological and information systems and stresses their self-organizing and co-evolutionary character. To systematize the use of the ecosystem metaphor in analysing and leading the establishment of data ecosystems and to take stock of the know-how in the field, the present paper proposes an analytical framework that draws on a synthesis of the current literature on data ecosystems. To demonstrate its practical value and its limitations, the framework has been applied to a concrete case: the Linked Open Data Ecosystem for the Performing Arts. The analytical framework rests on four key dimensions which represent the cornerstones of a data ecosystem: (i) data sharing; (ii) interoperability and shared infrastructures; (iii) stakeholder involvement; and (iv) economic sustainability. It is suggested that the ecosystem approach, along with the analytical framework provided in this paper, be used to lead the digital transformation in a variety of areas where data and information systems play an important role.

Keywords: e-government, digital transformation, public sector, data ecosystem, governance, leading change

This article has been published in Information Polity:
Estermann, B. (2025). Leading Public Sector Transformation through an Ecosystem Approach, *Information Polity, 30*(4), 338-357. DOI: 10.1177/15701255251394110

Key points for practitioners

- The digital transformation has led to fundamental changes in the way public administration operates, calling for a new paradigm in public sector governance.

- The ecosystem metaphor has been put forward as a tool for leading change in the public sector and beyond, as it accounts for the interdependency of social, technological and information systems and stresses their self-organizing and co-evolutionary character.

- To systematize this approach, an analytical framework has been developed based on a synthesis of the literature. To assess its practical value, it has been applied to an empirical case.

- The findings have been synthesized in the form of checklists for good data ecosystem governance along four dimensions: data sharing; interoperability and shared infrastructures; stakeholder involvement; and economic sustainability.

1 Introduction

As has been laid out in an earlier article, *"the digital transformation has resulted in increasingly integrated services, participative approaches and an emerging collaborative culture, accompanied by a break-up of proprietary data silos and their replacement by a commonly shared data infrastructure, allowing data to be freely shared, inter-linked and re-used"* (Estermann, 2018, p. 599). As a result, the digital transformation has led to fundamental changes in the way public administration operates, calling for a new paradigm in public sector governance, marking a departure from the managerial paradigm's focus on disaggregation and market-like arrangements for coordination and incentivization that had been popularized since the 1980s (Dunleavy et al., 2006; Margetts & Dunleavy, 2013; Dunleavy & Margetts, 2015; Estermann, 2018; Marti et al., 2022).

Furthermore, since the early 2000s, and thus predating the discourse about "digital transformation" and "digital era governance" (cf. Dunleavy et al., 2006), attention had increasingly been drawn to the appearance of a new form of governance, termed "collaborative governance", that can be seen as a response to implementation failures and to the high cost of regulation encountered within the managerial paradigm (Huxham et al., 2000; Ansell & Gash, 2008; Emerson et al., 2012): It can be defined as a *"governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets"* (Ansell & Gash 2008, p. 544). Some authors have pointed to the co-evolutionary relationship between "collaborative governance" and the digital transformation, with the latter reinforcing the dynamics that have led to the emergence of "collaborative governance" (Maulana & Dečman, 2023). The concept of "collaborative governance" is similar to the one of "adaptive governance" as a response to growing failures of scientific management (Brunner, 2010; Janssen & Van Der Voort, 2016; Wang et al., 2018). Having originally been proposed in the context of social-ecological systems, the concept of "adaptive governance" has since been applied to other contexts, including digital government. It acknowledges the dynamic nature and the ecosystem-like quality of the socio-technical environment in which organizations evolve (Janssen & Van Der Voort, 2016). At its core is the idea that decentralized organizations can tackle problems more effectively than top-down organizations. Therefore, its proponents preconize

decentralized decision-making, engagement of many stakeholders in decision-making, and the use of tacit decentralized knowledge (Janssen & Van Der Voort, 2016).

Collaborative or adaptive governance requires a certain level of ambidexterity in organizations, as they need to combine their striving towards stability and continuity with the readiness to constantly learn and adapt to swift changes in their environment (Janssen & Van Der Voort, 2016). It also relies on inter-organizational networks in which public sector organizations may retain varying degrees of decision-making power and accountability (cf. Wang et al., 2018).

Against this backdrop, the ecosystem metaphor has increasingly been put forward as a tool for leading change in the public sector and beyond, as it accounts for the interdependency of social, technological and information systems and stresses their self-organizing and co-evolutionary character (Nardi & O'Day, 1999). As Harrison et al. (2012) note, the ecosystem metaphor has become ubiquitous in the discourse related to open data, open government, and government as a platform, which are typical for later stages of e-government development (cf. Estermann, 2018). The metaphor has been popular among practitioners and scholars alike, as it puts the focus on the interactions between stakeholders who are involved in data-based value creation processes (Styrin et al., 2017).

In an effort to systematize the use of the ecosystem metaphor in analysing and leading the establishment of data ecosystems and to take stock of the know-how in the field, the present paper proposes an analytical framework that draws on a synthesis of the current literature on data ecosystems. To demonstrate its practical value and its limitations, the resulting framework has been applied to an empirical case.

2 Definition of key concepts

Governance is about collective decision making and applies to jointly determined rules and norms designed to regulate individual and group behaviour to ensure the provision of public goods or the solving of societal problems (Ansell & Gash, 2008; Klijn, 2008; Emerson et al., 2012). Thus, "governance" refers to the rules, roles and behavioural patterns which configure the way collective action occurs. Regarding the governance of data infrastructures, Estermann et al. (2018) identify seven dimensions requiring coordination at the data ecosystem level: ethical, legal, political, economic,

organizational, semantic, and technical. These were taken as a starting point for our analysis.

Given its prominent role in some of the sources, a "leadership" dimension was added to the analysis. Furthermore, "promotion of personal skills" and "promotion of organizational capabilities", which also figured quite prominently in the literature, were retained as further aspects to be coordinated at the ecosystem level:

Leadership refers to the function in an organizational setting that ensures that the "job gets done" by developing and supporting followers and directing their actions towards a common goal. Faced with a changing environment, leadership has been shown to be an important driver of organizational change (Kuipers et al. 2014). In complex environments, effective leadership demands from leaders that they take on an entrepreneurial or a stewardship role (Van Wart, 2003), considering the network as a whole, providing a shared vision, balancing the network's unity and diversity, and acting as role models with regard to the pursuit of organizational values and organizational outcomes (Wright et al., 2012; Vogel & Masal, 2015).

Organizational capabilities are understood as an organization's capacity to deploy its resources to perform a task or activity to improve performance or to achieve a particular result, including organizational change (Inan & Bititci 2015; Collis 1994). The enhancement of organizational capabilities may take place within an individual organization or within the organizational network it is embedded in.

Skills are the ability of individuals "to apply knowledge and use know-how to complete tasks and solve problems" (McCallum et al., 2018, p. 176). To put their skills into action, individuals generally require domain knowledge and the right set of attitudes (values, aspirations, priorities), which act as motivators of performance (ibid.). Furthermore, skilled individuals oftentimes rely on some form of collective organization and organizational readiness to put their skills into effect (Khan, 2019).

3 Synthesis of the literature

3.1 Materials and method

Systematic Literature Reviews (SLRs) are a means to derive current best evidence from research (Petticrew & Roberts, 2008; Kitchenham et al., 2009). While SLRs often pertain to quantitative studies (Kitchenham, 2004; Petticrew & Roberts, 2008), it is generally accepted in the social sciences that SLRs may also pertain to qualitative

studies and address qualitative issues (Petticrew & Roberts, 2008). As can be seen in table 1, publications about data ecosystems are typically qualitative in nature.

Table 1. Publications on data ecosystems retained for the analysis.

Davies (2012)	Conference paper stressing the fact that publishing open datasets is not enough, that intervention beyond dataset supply is needed to support and coordinate activities around datasets. Drawing on two case studies.
Deloitte (2012)	White paper advancing a business perspective on open data. Based on own views, evidence from examples of open data in business, and qualitative evidence gathered through roundtable discussions with executives from private and public sector organizations.
Hall et al. (2012)	Report pointing to the increasing role of open data in the charitable sector.
Harrison et al. (2012)	Journal article examining the concept of open government from an ecosystem perspective, suggesting that policy makers need to engage in strategic ecosystem thinking. Based on inputs gathered at a workshop with representatives from the government, academic and civil society communities.
Kontokosta (2013)	Journal paper exploring the mechanisms by which information can alter market behavior in the commercial real estate sector.
Ubaldi (2013)	Working paper highlighting the main principles, concepts and criteria framing open government data initiatives and the issues challenging their implementation.
Gama & Loscio (2014)	Conference paper advancing the idea of creating a software ecosystem for services and applications underpinned by a platform based on open data as a service.
Heimstädt et al. (2014)	Journal article providing a narrative timeline of open data ecosystem development in the UK. Based on a combination of discourse analysis of open data definitions and business ecosystem theories and a content analysis of in-depth interviews.
Immonen et al. (2014)	Journal article outlining an open data ecosystem and defining the requirements of such an ecosystem from a business viewpoint. Based on a literature analysis and interviews with Finnish industry representatives.
Zuiderwijk et al. (2014)	Journal article providing an overview of the elements of open data ecosystems that are essential for enabling easy publication and use of open data. Based on a review of the literature and a scenario.
Bourne et al. (2015)	Journal article discussing the cost of sustaining biomedical big data and the resources needed to make them useful.
Masuzzo & Martens (2015)	Journal article calling for the establishment of an open data ecosystem for cell migration research.
Ponte (2015)	Conference paper providing an analysis of the “enablers” of an open data ecosystem, i.e. those actors that provide the technical infrastructure facilitating the sharing, linking and re-use of open data.
Dawes et al. (2016)	Journal article presenting a preliminary ecosystem model for planning and designing OGD programs. Based on two empirical case studies in New York and St. Petersburg, Russia.
Lindman et al. (2016)	Journal article proposing a model to categorize the roles businesses can have in enriching open data.
Van Schalkwyk et al. (2016)	Journal article analyzing the role of intermediaries in the South African public university open data ecosystem. Based on a case study.
Jetzek (2017)	Book chapter proposing an economic model that can make the sustainable value of open data more explicit to governments, businesses, and individuals, and thereby act to resolve the open data value paradox (downward-facing spiral due to a lack of useful data and a lack of investment in better data due to limited data use).
Kitsios et al. (2017)	Conference paper examining the actors of open data ecosystem and their relationships from a business point of view. Based on 6 stakeholder interviews.
Martin et al. (2017)	Book chapter postulating the need for a stimulator (leadership) function within open data ecosystems. Based on the analysis of several models of open data ecosystems.
Styrin et al. (2017)	Journal article providing a comparative analysis of the data ecosystems of Mexico, Russia, and the USA. Based on document analysis.
Welle Donker & van Loenen (2017)	Journal article proposing a holistic open data framework for assessing the maturity of open data ecosystems. Based on a literature review and stakeholder interviews.
Klievink et al. (2018)	Journal article proposing a conceptual model for data collaboratives based on a qualitative longitudinal case study covering 25 years of development and evolution of a mobility data platform in the Netherlands.

Jensen & Campbell (2019)	Discussion paper calling for the establishment of a digital ecosystem for the environment as a global public good, governed through an international process backed by the UN as a tool to monitor the earth's health and the achievement of the sustainable development goals.
Lnenicka & Komarkova (2019)	Journal article proposing a conceptual framework that can be used to identify essential elements of a big and open linked data ecosystem and their relationships. Based on a literature review.
Bonina & Eaton (2020)	Journal article proposing a governance model for open government data platform ecosystem cultivation. Based on three empirical cases from Mexico City, Buenos Aires, and Montevideo.
Estermann (2020)	Journal article calling for the creation of an international linked data ecosystem for the performing arts. Drawing on first-hand experience of the author in the context of linked open data projects in various segments of the performing arts value network.
Gupta et al. (2020)	Journal article shedding light on how public authorities coordinate smart city data ecosystems form an orchestration perspective. Based on a qualitative case study approach of London's city data environments.
van Donge et al. (2022)	Journal article analyzing the role of data stewardship in data ecosystems, based on a comparison of three empirical cases, two from the Netherlands and one with a pan-European scope.

Consequently, our goal is to provide a synthesis of the literature that is qualitative in nature. Quantification is used only for triangulation purposes and to synthesize the findings. This has a series of implications for our methodological approach:

Selection of primary studies: Given the qualitative nature of our literature review, heterogeneity of perspectives represented in the selection was more important than comprehensiveness, and the stopping point for the search was assessed in terms of "theoretical saturation" (Petticrew & Roberts, 2008). To account for the heterogeneity of perspectives on the topic of data ecosystems (Zuiderwijk, Janssen, & Davis 2014), the search terms *"data ecosystem"* and *"digital ecosystem"* were used in combination with the search term *"governance"* on Google Scholar to pinpoint relevant publications both from the research and the practice literature. From there, the search was extended to the literature cited in these publications, proceeding in several iterations. Eventually, 28 papers and reports on data ecosystems were retained that cover governance issues in sufficient depth to serve as a basis for the analytical framework (see table 1 for an overview of the publications).

Some early contributions were omitted as they did not exactly fit our retention criteria. Four of them are worth mentioning, as they have inspired several of the other papers: Nardi & O'Day (1999) put the focus on "information ecologies" in a call to abandon a predominantly technology-centred view and to put the spotlight instead on human activities that are served by technology. Similarly, Huvila (2009) developed a framework, based on systems theory and the ecological approach, in order to explicate

the contextual interplay of information interactions and infrastructures of information. Pollock (2011) as well as Poikola, Kola, & Hintikka (2011) were among the first protagonists of the open data movement to draw the attention to the fact that simple data provision on data portals was not enough, that the relationship between data publishers and data users was not a "one-way street", but that the focus should be put on data cycles and feedback-loops instead.

Study quality assessment: All the primary studies are qualitative in nature. While some of the studies cite an explicit empirical basis, others reflect expert views in relation to a specific implementation context (see table 1).

Data analysis: The selected publications (full texts) were subjected to a qualitative content analysis (Hsieh & Shannon, 2005) following a directed approach. In a first step, text passages that mentioned aspects related to ecosystem governance or inter-organizational coordination were identified. For the initial categorization of text passages Atlas.ti was used. In a first round, the text passages were to the extent possible assigned to the seven governance dimensions proposed by Estermann et al. (2018). These initial dimensions were then complemented by three further aspects to be coordinated at the ecosystem level, which figured quite prominently in the literature: "leadership", "promotion of personal skills", and "promotion of organizational capabilities". As it turned out, these 10 dimensions were sufficient to assign each text passage to at least one dimension. For each of the 10 dimensions, the text passages were then assigned to sub-categories.

Data synthesis: Sub-categories that contained text passages from at least two sources were retained (see table 2) and arranged in a multipolar mind map, allowing to visualize the connections between them and to identify meaningful clusters that could be used to structure the analytical framework. Minor adjustments to the cluster names were made to align the clusters derived from the literature with the clusters derived from the empirical case (see below).

Table 2. Sub-categories derived from the literature.

Dimension	Sub-category	Sources
Ethical	Strike a balance between ensuring the privacy of individuals and utilizing the full potential of the data available	**(a)** Jensen & Campbell (2019); Jetzek (2017); Kontokosta (2013); Lnenicka & Komarkova (2019); Ubaldi (2013)
	Establish when it is appropriate to share what type of data with whom, and who will have authority over which data	Estermann (2020); Jensen & Campbell (2019); Harrison et al. (2012); Ubaldi (2013)
	Hold a public debate to recalibrate society's conventions and increase the moral standards applied to businesses towards privacy and the responsible use of data	Deloitte (2012); Hall et al. (2012)
Legal	Create a legal framework that sets clear responsibilities and limitations regarding the sharing of data	**(b)** Bonina & Eaton (2020); Dawes et al. (2016); van Donge et al. (2022); Harrison et al. (2012); Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kontokosta (2013); Lnenicka & Komarkova (2019); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Remove the legal barriers that restrict the access to and use of data	**(c)** Davies (2012); Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Lnenicka & Komarkova (2019); Ubaldi (2013)
	Adopt access to information laws and procedures as a pre-requisite to PSI re-use	Bonina & Eaton (2020); Dawes et al. (2016); Heimstädt et al. (2014); Ubaldi (2013)
	Establish new policies and practices regarding privacy protection and the responsible use of data, taking into account the rapid advances in information and communication technology	Deloitte (2012); Hall et al. (2012); Jensen & Campbell (2019)
	Employ an open source approach to software development with relaxed or non-existent copyright protection, encouraging collaborative production of software systems	Gupta et al. (2020); Harrison et al. (2012); Jensen & Campbell (2019)
	Provide clear intellectual property rights	Immonen et al. (2014); Jensen & Campbell (2019)
	Support the development of contracts between actors of ecosystems	Immonen et al. (2014); Kitsios et al. (2017)
Political	Adopt full (open) data policies which foster innovation, ensure privacy protection, and facilitate data sharing and re-use	**(d)** Bonina & Eaton (2020); Davies (2012); Dawes et al. (2016) ; Heimstädt et al. (2014); Jensen & Campbell (2019); Styrin et al. (2017); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Promote open data policies through international cooperation	Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019)
	Recognize the importance for governments to act as catalysts and convenors of stakeholders by supporting coordination of activity around datasets	Davies (2012); Dawes et al. (2016); Ubaldi (2013)
	Recognize the importance for governments to act as competent data analysts and data consumers	Dawes et al. (2016); Gupta et al. (2020); Ubaldi (2013)
Organizational	Create open data initiatives involving diverse stakeholder groups from the public and private sectors as well as civil society as parts of an ecosystem	**(e)** Bonina & Eaton (2020); Davies (2012); Dawes et al. (2016); van Donge et al. (2022); Gama & Loscio (2014); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Klievink et al. (2018); Lnenicka & Komarkova (2019); Martin et al. (2017); Styrin et al. (2017); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Ensure that all key stakeholder groups are represented within a given data ecosystem	**(f)** Bonina & Eaton (2020); Bourne et al. (2015); Dawes et al. (2016); Gama & Loscio (2014); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Kontokosta (2013); Lnenicka & Komarkova (2019); Masuzzo & Martens (2015); Styrin et al. (2017); Ubaldi (2013); Van Schalkwyk et al. (2016)
	Make sure that central roles are appropriately filled within a given data ecosystem	**(g)** Bonina & Eaton (2020); Dawes et al. (2016); van Donge et al. (2022); Gupta et al. (2020); Harrison et al. (2012); Klievink et al. (2018); Van Schalkwyk et al. (2016)
	Ensure full adoption of open data practices by (public sector) organizations	**(h)** Bonina & Eaton (2020); Bourne et al. (2015); Davies (2012); Dawes et al. (2016); Gama & Loscio (2014); Harrison et al. (2012); Heimstädt et al. (2014); Jensen & Campbell (2019); Martin et al. (2017); Styrin et al. (2017); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Pay sufficient attention to the user perspective	Dawes et al. (2016); Harrison et al. (2012); Jensen & Campbell (2019); Ubaldi (2013); Zuiderwijk et al. (2014)
	Establish new governance structures	Deloitte (2012); van Donge et al. (2022); Estermann (2020); Harrison et al. (2012); Klievink et al. (2018)
	Create open government / open innovation ecosystems	Gupta et al. (2020); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019
Economic	Secure the sustainability of the ecosystem by ensuring that those who make important contributions also experience its benefits	**(i)** Dawes et al. (2016); Estermann (2020); Gupta et al. (2020); Heimstädt et al. (2014); Immonen et al. (2014); Kitsios et al. (2017); Lindman et al. (2016); Lnenicka & Komarkova (2019); Martin et al. (2017); Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Explore and establish new business models around (open) data	**(j)** Bourne et al. (2015); Dawes et al. (2016); Estermann (2020); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Lindman et al. (2016); Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Establish a marketplace around data, services and applications	**(k)** Gama & Loscio (2014); Gupta et al. (2020); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Martin et al. (2017) Ponte (2015)

	Ensure that open data initiatives are developed from a demand-driven perspective and have a clear value-adding business case	**(l)** Davies (2012); Dawes et al. (2016); Harrison et al. (2012); Jensen & Campbell (2019); Jetzek (2017); Kontokosta (2013); Martin et al. (2017) Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016)
	Help overcome funding constraints or potential loss of revenue by making initial investments	**(m)** Davies (2012); Dawes et al. (2016); van Donge et al. (2022); Gupta et al. (2020); Hall et al. (2012); Jetzek (2017); Lindman et al. (2016); Martin et al. (2017) Ubaldi (2013); Welle Donker & van Loenen (2017)
	Ensure the fairness of exchanges among ecosystem participants	**(n)** van Donge et al. (2022); Gupta et al. (2020); Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019); Martin et al. (2017)
	Do not underestimate the cost of maintaining the data infrastructure and seek to improve its efficiency	Bourne et al. (2015); van Donge et al. (2022); Harrison et al. (2012); Ubaldi (2013)
	Overcome the hen-and-egg problem of data provision and the creation of value-added services	Estermann (2020); Jensen & Campbell (2019); Jetzek (2017)
	Develop collaborative funding models	Bourne et al. (2015); Estermann (2020)
Semantic	Establish common metadata standards to describe datasets	**(o)** Bourne et al. (2015); Dawes et al. (2016); Hall et al. (2012); Harrison et al. (2012); Jensen & Campbell (2019); Masuzzo & Martens (2015); Ubaldi (2013)
	Establish standards for harmonizing / integrating different data sources to facilitate information sharing	**(p)** Bonina & Eaton (2020); van Donge et al. (2022); Gama & Loscio (2014); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Klievink et al. (2018); Kontokosta (2013); Masuzzo & Martens (2015); Ubaldi (2013); Zuiderwijk et al. (2014)
	Develop and use shared ontologies	**(q)** Davies (2012); Dawes et al. (2016); Estermann (2020); Hall et al. (2012); Kontokosta (2013); Ubaldi (2013); Zuiderwijk et al. (2014)
	Provide and use uniform unique identifiers for named entities (authority files, base registers)	**(r)** Bourne et al. (2015); Estermann (2020); Hall et al. (2012); Kontokosta (2013); Ubaldi (2013); Zuiderwijk et al. (2014)
	Provide stable and well documented APIs to facilitate the access to data sources	Immonen et al. (2014); Lindman et al. (2016)
	Publish / aggregate data as linked (open) data	Davies (2012); Hall et al. (2012); Ubaldi (2013)
Technical	Ensure technical interoperability by developing and maintaining open technical and content standards	**(s)** Davies (2012); Dawes et al. (2016); Gama & Loscio (2014); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Lindman et al. (2016); Masuzzo & Martens (2015); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Establish a stable data infrastructure that is scalable, available and reliable	**(t)** Bonina & Eaton (2020); Davies (2012); van Donge et al. (2022); Gama & Loscio (2014); Kontokosta (2013); Lnenicka & Komarkova (2019); Ubaldi (2013)
	Create and provide common tools and services for working with data	**(u)** Bonina & Eaton (2020); Bourne et al. (2015); Davies (2012); Gama & Loscio (2014); Immonen et al. (2014); Jensen & Campbell (2019); Kitsios et al. (2017); Lnenicka & Komarkova (2019)
	Provide an IT-based platform to promote interactions between the actors of the data ecosystem, facilitating the creation of innovative products and services	Bonina & Eaton (2020); Gama & Loscio (2014); Lnenicka & Komarkova (2019)
	Remove the technical barriers that restrict access to data	Davies (2012); Ubaldi (2013)
	Align the innovation tasks, components, and interactions of the members of the ecosystem to promote modularity of software applications in order to avoid duplication of work	Martin et al. (2017) Ubaldi (2013)
	Design commercial digital ecosystems that are fully interoperable with other private and public ecosystems	Jensen & Campbell (2019); Lnenicka & Komarkova (2019)
Leadership	Provide leadership based on strategic ecosystem thinking	Dawes et al. (2016); Harrison et al. (2012); Jensen & Campbell (2019); Martin et al. (2017) Welle Donker & van Loenen (2017)
	Create a common vision for the ecosystem	Estermann (2020); Gupta et al. (2020); Jensen & Campbell (2019); Klievink et al. (2018); Welle Donker & van Loenen (2017)
	Stimulate engagement, fostering participation, collaboration, and cooperation	Jensen & Campbell (2019); Lnenicka & Komarkova (2019); Ubaldi (2013)
Organizational Capabilities	Help organizations acquire the necessary technical skills and capabilities to make use of data	**(v)** Dawes et al. (2016); Deloitte (2012); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Jensen & Campbell (2019); Lnenicka & Komarkova (2019)
	Help data owners acquire the skills and capabilities needed to share their data and to adapt their practices	**(w)** Dawes et al. (2016); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Help organizations embrace the new open data culture	Hall et al. (2012); Immonen et al. (2014); Ubaldi (2013)
	Provide organizations with the possibility to outsource data-related services	Deloitte (2012); Hall et al. (2012)
Skills	Help individuals acquire the specialized technical know-how required for the publication and use of data	**(x)** Dawes et al. (2016); Deloitte (2012); Gupta et al. (2020); Hall et al. (2012); Jensen & Campbell (2019); Jetzek (2017); Lnenicka & Komarkova (2019); Ponte (2015); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Educate data providers and data users about the implications of open data	**(y)** Deloitte (2012); Gupta et al. (2020); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Ubaldi (2013)
	Promote among ecosystem participants a mindset that is open to the sharing of data, experimentation and change	Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Ubaldi (2013)
	Provide training to citizens and potential data users	Harrison et al. (2012); Jensen & Campbell (2019); Ubaldi (2013)

3.2 Key findings from the literature

From the analysis, four inter-related clusters emerged that can be seen as the cornerstones of a data ecosystem: (i) data sharing; (ii) interoperability and shared infrastructures; (iii) stakeholder involvement; and (iv) economic sustainability. To facilitate the reader's orientation, aspects that were mentioned by at least six sources (20%) are bolded. For reasons of conciseness, aspects that were mentioned by fewer sources are used to exemplify and to illustrate the more prominent points but are not systematically reported in detail. A full list of aspects retained (sub-categories) is provided in table 2. Latin superscripts in the text refer to sources listed in that same table.

3.2.1 Data sharing

At the core of this cluster are elements of the political, legal, and organizational dimensions, complemented by measures to improve organizational capabilities and skills. The main task in this area consists in creating a **legal framework that sets clear responsibilities and limitations regarding the sharing of data**[b] and in ensuring **full adoption of open data practices among organizations**[h]. This includes establishing a set of formal directives, rules and practices that apply to public sector organizations and require them to make their data available as open data in an appropriate format (Davies, 2012; Dawes et al., 2016; Heimstädt et al., 2014; Jensen & Campbell, 2019; Masuzzo & Martens, 2015; Styrin et al., 2017; Ubaldi, 2013; Welle Donker & van Loenen, 2017). While some authors focus the call for open data policies primarily on data held by public sector organizations, others extend the scope to all publicly funded data (Jensen & Campbell, 2019) or even to certain types of private data (Kontokosta, 2013).

When it comes to the sharing of data, a balance needs to be struck between ensuring the privacy of individuals on the one hand and utilizing the full potential of the data available on the other[a]. From a political point of view, it is crucial that **comprehensive open data policies be adopted that foster innovation, ensure privacy protection, and facilitate data sharing and re-use**[d]. In terms of legislation, it is important to **remove the legal barriers that restrict access to and the use of data**[c]. The adoption of data sharing practices by organizations can be further accelerated by **educating data providers and data users about the implications of open data**[y], as well as by **helping data owners acquire the skills and capabilities needed to share their data and to adapt their practices**[w]. It has been pointed out by several authors that

organizations acting as data providers require a whole set of capabilities: They need formal data publication plans, institutional structures, and processes to disclose data (Dawes et al., 2016; Hall et al., 2012; Harrison et al., 2012; Ubaldi, 2013). They need to understand the implications of data protection, privacy and safeguarding issues and need to have good data governance practices in place (Hall et al., 2012; Harrison et al., 2012; Ubaldi, 2013; Welle Donker & van Loenen, 2017). Furthermore, they require means to communicate with data users to assess their expectations and requirements and to promote data use (Dawes et al., 2016; Harrison et al., 2012; Ubaldi, 2013; Welle Donker & van Loenen, 2017).

3.2.2 Interoperability and shared infrastructures

At the core of this cluster are elements of the technical and semantic dimensions, complemented by measures at the network level that enhance the organizational capabilities of its members. One of the key aspects mentioned by roughly half of the sources consists in **ensuring technical interoperability by developing and maintaining open technical and content standards[s]**. This applies to software standards, standard formats, as well as standard APIs for data exchange. A data ecosystem furthermore requires a **stable data infrastructure that is scalable, available, and reliable[t]**. This infrastructure should include a data portal providing information about available data (Dawes et al., 2016; Immonen et al., 2014; Lnenicka & Komarkova, 2019) and provide a system to track data provenance and authenticity (Dawes et al., 2016; Estermann, 2020; Immonen et al., 2014; Jensen & Campbell, 2019; Ubaldi, 2013), data quality, as well as the technical and semantic interoperability of the data (Dawes et al., 2016; Harrison et al., 2012; Immonen et al., 2014; Jensen & Campbell, 2019).

To achieve semantic interoperability of the data, it is important to establish **best practices and standards for harmonizing and integrating different data sources[p]**. This includes the development and use of **shared ontologies[q]** and the provision and use of **uniform unique identifiers for named entities (authority files, base registers)[r]**. Some authors also mention the provision of stable and well documented APIs to facilitate the access to data sources (Immonen et al., 2014; Lindman et al., 2016) or the publication of data as linked open data (Davies, 2012; Hall et al., 2012; Ubaldi, 2013). To facilitate the findability and the first assessment of the data, it is important to establish **common**

metadata standards to describe datasets[o], thereby ensuring the interoperability of data catalogues (Davies, 2012; Masuzzo & Martens, 2015; Ubaldi, 2013).

3.2.3 Stakeholder involvement

At the core of this cluster are elements of the ethical, the organizational and the leadership dimensions, complemented by the promotion of personal skills and organizational capabilities. Over half of the sources call for the **creation of open data ecosystems involving diverse stakeholder groups from the public and private sectors as well as civil society**[e]. They stress the importance of **ensuring that all key stakeholder groups are represented within a given data ecosystem**[f]. To do so, many authors call for **active government interventions to stimulate an ecosystem of data producers, innovators, and users** (Dawes et al., 2016; Gama & Loscio, 2014; Harrison et al., 2012; Jensen & Campbell, 2019; Jetzek, 2017; Martin et al, 2017; Styrin et al., 2017; Ubaldi, 2013; Van Schalkwyk et al., 2016). They also point to the importance of **promoting collaboration among the various stakeholders of the data ecosystem to ensure data harmonization and innovation coherence** (Bourne et al., 2015; Davies, 2012; Dawes et al., 2016; Gama & Loscio, 2014; Hall et al., 2012; Lnenicka & Komarkova, 2019; Martin et al, 2017; Ubaldi, 2013). One proven method to foster collaboration is the **organization of hackathons, data jams, or apps competitions where stakeholders meet to engage in a co-creative process around open data** (Dawes et al., 2016; Harrison et al., 2012; Jetzek, 2017; Kitsios et al., 2017; Martin et al, 2017; Styrin et al., 2017; Ubaldi, 2013). Several authors stress that **central roles need to be appropriately filled within a given data ecosystem**[g].

The **key stakeholder groups to be involved in the data ecosystem comprise (i) data providers**[f]; **(ii) direct (open) data users**, such as transparency advocates, expert data analysts, and members of the civic technology community who develop pro-bono and commercial applications with open data[f]; **(iii) the beneficiaries of (open) data use**, comprising both individuals and organizations in the larger society who adopt, buy, and use the products and services that open data has made possible[f]; **(iv) data enhancers (extractors, transformers, aggregators)** (Gama & Loscio, 2014; Immonen et al., 2014; Lindman et al., 2016; Lnenicka & Komarkova, 2019; Martin et al, 2017; Ponte, 2015; Ubaldi, 2013; Zuiderwijk et al., 2014); as well as **(v) enablers providing the tools and support to make (open) data accessible to other actors in the market** (e.g.

infrastructure and tool providers) (Hall et al., 2012; Immonen et al., 2014; Jensen & Campbell, 2019; Ponte, 2015; Ubaldi, 2013; Van Schalkwyk et al., 2016; Zuiderwijk et al., 2014).

In terms of skills development, measures should be taken to **educate data providers and data users about the implications of open data**[y] and to **help individuals acquire the specialized technical know-how required for the publication and use of data**[x], such as data management and preparation skills (Dawes et al., 2016; Hall et al., 2012; Ponte, 2015; Ubaldi, 2013), data analysis skills (Dawes et al., 2016; Deloitte, 2012; Hall et al., 2012; Jensen & Campbell, 2019; Ponte, 2015; Ubaldi, 2013), or software development skills (Dawes et al., 2016; Hall et al., 2012; Ponte, 2015; Ubaldi, 2013; Welle Donker & van Loenen, 2017).

Several authors point to the importance of paying sufficient attention to the user perspective (Dawes et al., 2016; Harrison et al., 2012; Jensen & Campbell, 2019; Ubaldi, 2013; Zuiderwijk et al., 2014), which has implications not only on the organizational, but also on various other dimensions: From an organizational point of view, sufficient emphasis should be put on feedback and the interdependencies among suppliers, users, and intended beneficiaries (Dawes et al., 2016; Immonen et al., 2014; Jensen & Campbell, 2019; Ubaldi, 2013; Zuiderwijk et al., 2014); from an economic point of view, it is crucial **that open data initiatives be developed from a demand-driven perspective and have a clear value-adding business case**[l]; from a technical perspective, it is important that **common tools and services for working with data are provided**[u]; and with regard to the development of organizational capabilities, it is important to **help organizations acquire the necessary technical skills and capabilities to make use of data**[v].

3.2.4 Economic sustainability

At the core of this cluster are elements of the economic dimension: First of all, it is absolutely crucial to **secure the sustainability of the ecosystem by ensuring that those who make important contributions to it also experience its benefits**[i]. Thus, it is important to ensure that added value is created for those stakeholders who are expected to make an additional effort to provide or to enhance data. In fact, many actors of the ecosystem may require assistance in defining appropriate business models that are in line with the philosophy and the workings of an open data ecosystem (Immonen et al. 2014; Kitsios et al., 2017; Lindman et al., 2016; Ubaldi, 2013; Welle Donker & van Loenen,

2017). To that effect, it is necessary to **explore and establish new business models around (open) data which consider supply and demand**[j]. Furthermore, it should be assessed where open data infrastructures are best developed as public goods, and where market- or regulation-based approaches to ensure their provision are appropriate (Davies, 2012; Dawes et al., 2016; Hall et al., 2012; Jensen & Campbell, 2019).

During the build-up phase **it can be helpful if governments or charities make initial investments to help overcome funding constraints or potential loss of revenue**[m].

In the longer run, it is important to **ensure that open data initiatives are developed from a demand-driven perspective and have a clear value-adding business case**[l]. Several authors stress the importance of demonstrating visible impact of data to secure ongoing resources required for infrastructure maintenance and development (Davies, 2012; Harrison et al., 2012; Van Schalkwyk et al., 2016). It is therefore important that ecosystem participants identify which datasets are economically or socially valuable (Estermann, 2020; Harrison et al., 2012; Styrin et al., 2017) and respond to the demand for actionable, policy relevant insights and public good applications (Jensen & Campbell, 2019; Kontokosta, 2013; Ponte, 2015).

Several authors point to the **importance of establishing a marketplace around data, services, and applications**[k], which has implications not only on the economic, but also on various other dimensions: From an economic point of view, it is important to ensure the fairness of exchanges among the participants of the ecosystem (Heimstädt et al., 2014; Immonen et al., 2014; Jensen & Campbell, 2019; Martin et al, 2017). On a technical level, an IT-based platform could be provided that promotes interactions between the participants of the data ecosystem, facilitating the creation of innovative products and services (Bonina & Eaton, 2020; Gama & Loscio, 2014; Lnenicka & Komarkova, 2019). And finally, as regards the development of organizational capabilities, organizations could be offered the possibility to outsource certain data-related services, which would free them from the obligation to develop all the required capabilities internally (Deloitte, 2012; Hall et al., 2012).

4 Application to an empirical case

To demonstrate the practical use of the analytical framework and to complement the findings from the literature with insights from an empirical case, 17 expert interviews

were conducted with members of a network in the process of establishing a linked open data ecosystem for the performing arts (LODEPA). The key components of LODEPA, such as the performing arts value network with the main stakeholders, their use cases, their requirements in terms of data and the technical architecture have been described in detail by Estermann & Julien (2019) and Estermann (2020): The vision consists in the development of a distributed knowledge base for the performing arts, based on a linked open data approach which facilitates the development of applications making use of the shared data.

The LODEPA network mainly consists of artists, arts organizations (artists collectives, production companies, arts presenting organizations), research and educational organizations, heritage institutions, as well as a variety of service providers, including providers of data platforms. While some of the organizations involved are governed by public law, others are constituted as private organizations, both for profit and non-profit. Still, a large fraction of the sector's activities is publicly funded and thus directly affected by public funding policies.

4.1 Materials and method

To explore the application of the framework in a practical setting, interviews were carried out with a variety of stakeholders from within the LODEPA network (see table 3 for an overview of the organizational background of the interviewees). The interviews were carried out in 2020, independently from the literature analysis. The questionnaire focused on the aspects that were salient in the exchanges among the network members at that time. It systematically covered the role data played within the given organization, data sharing policies, opportunities and challenges related to LODEPA, required skills and organizational capacities both at an organizational and at the network level, as well as aspects of data and network governance.

The interview transcripts were subjected to the same type of qualitative content analysis as the publications from the literature. Again, sub-categories that contained text passages from at least two sources were retained for further analysis (see table 4) and arranged in a multipolar mind map and clustered along the four themes: (i) data sharing; (ii) interoperability and shared infrastructures; (iii) stakeholder involvement; and (iv) economic sustainability. To facilitate the reader's orientation, aspects that were mentioned by at least four interviewees (20%) are bolded. For reasons of conciseness,

aspects that were mentioned by fewer interviewees are used to exemplify and to illustrate the more prominent points but are not systematically reported in detail. A full list of aspects retained (sub-categories) is provided in table 4. Greek superscripts in the text refer to interviews listed in that same table.

Table 3. Overview of the organizational background of interviewees

ID	Organization	Stakeholder group(s)
Int-1	36 Monkeys	theatre production companies
Int-2	Arts and Theatre Institute, Prague	theatre archives
Int-3	AusStage	platform providers
Int-4	Austrian Center for Digital Humanities and Cultural Heritage	theatre archives; theatre research; digital humanities
Int-5	Bern Academy of the Arts, Music Division	music interpretation research
Int-6	Canadian Association for the Performing Arts (CAPACOA)	service organizations; sector associations (arts presenting organizations, production companies)
Int-7	Frankfurt University Library, Specialized Information Service Performing Arts	platform providers
Int-8	IbsenStage	platform providers
Int-9	Insubria University, Department of Human Sciences and Innovation for the Territory	digital humanities
Int-10	Macedonian Center of the International Theatre Institute	non-profit organizations (promotion of performing arts)
Int-11	Stage Page	service organizations
Int-12	University of Avignon, Arts, Humanities and Languages Section	theatre research
Int-13	University of Vilnius, Department of Screen and Performative Communication	digital humanities
Int-14	University of Würzburg, Chair of Computational Philology and Modern German Literary History	theatre research; digital humanities
Int-15	University Tor Vergata Roma, Department of Literary, Philosophical and Art History Studies	theatre research
Int-16	Wiki Movimento Brasil	non-profit organizations (free knowledge)
Int-17	Wikimedia Sweden	non-profit organizations (free knowledge)

Table 4. Sub-categories derived from the interviews.

Dimension	Sub-category	Interviews
Ethical	Design the ecosystem in an inclusive manner	**(α)** Int-3, Int-7, Int-14, Int-16
Legal	Deal with the impediments caused by intellectual property rights when it comes to the sharing of content	**(β)** Int-1, Int-4, Int-5, Int-8, Int-11, Int-12, Int-13
	Use Creative Commons licenses to facilitate the sharing of content	Int-1, Int-6
	Reduce the insecurity over author rights	Int-1, Int-8
	Take measures against intellectual property theft at the collective level	Int-1, Int-10

Organizational	Have organizations take a pro-active approach towards data management and archiving	**(γ)** Int-1, Int-7, Int-8, Int-9, Int-10, Int-14, Int-15, Int-17
	Ensure sufficient technical skills among staff members	**(δ)** Int-1, Int-3, Int-4, Int-7, Int-12, Int-14, Int-16
	Have data stewards promote the sharing of data across the sector	**(ε)** Int-10, Int-14, Int-15, Int-17
	Have an institution coordinate the documenting and archiving of performing arts related material at a national level or at the level of a language region	**(ζ)** Int-1, Int-2, Int-7, Int-8
	Design the ecosystem in a robust manner, avoiding excessive centralization	Int-4, Int-7, Int-17
	Address the skills shortage in the area of linked data, data science, and machine learning	Int-6, Int-11
	Establish best practices and guidelines regarding the sharing of data	Int-4, Int-14
	Wikidata plays a key role when it comes to establishing a shared infrastructure and practices for sharing arts data	Int-2, Int-6
	Have organizations embrace an open data approach wherever the rights situation allows for it	Int-2, Int-4
Economic	Secure the necessary project funding	**(η)** Int-2, Int-3, Int-8, Int-9, Int-10, Int-11, Int-12, Int-13
	Secure the necessary resources for data management and digitization	**(θ)** Int-3, Int-6, Int-8, Int-9, Int-11, Int-12, Int-17
	Improve the institutional funding situation of theatres and academic collections	**(ι)** Int-1, Int-7, Int-8, Int-10, Int-14
Semantic	Establish a shared ontology for the performing arts	**(κ)** Int-2, Int-3, Int-4, Int-7, Int-11, Int-15, Int-16
	Establish best practices regarding ontologies and standards	**(λ)** Int-4, Int-7, Int-8, Int-14, Int-16, Int-17
Technical	Develop and establish common data infrastructures and tools	**(μ)** Int-1, Int-4, Int-5, Int-10, Int-11, Int-14
	Provide tools for data transformation and publication	Int-8, Int-14, Int-17
Leadership	Get specific change agents to promote the intended change	**(ν)** Int-4, Int-5, Int-6, Int-8, Int-11, Int-12, Int-14, Int-17
Organizational Capabilities	Make sure that organizations have access to qualified personnel (IT skills and domain expertise) to work on data management tasks	**(ξ)** Int-1, Int-2, Int-8, Int-10, Int-11, Int-12, Int-14, Int-16, Int-17
	Set up training programs to promote skills building	**(π)** Int-3, Int-6, Int-8, Int-13, Int-14, Int-16, Int-17
	Have third parties bring the necessary technical skills to network participants	**(ρ)** Int-2, Int-4, Int-7, Int-8, Int-10, Int-11, Int-17
	Foster peer learning	**(σ)** Int-3, Int-6, Int-8, Int-11, Int-13, Int-16
	Ensure that organizations have access to adequate infrastructures and tools for the management of the data and content they hold	**(τ)** Int-4, Int-5, Int-8, Int-11, Int-14
	Exploit synergies at the network level to provide access to shared digital infrastructures	**(υ)** Int-2, Int-8, Int-10, Int-14
	Ensure that organizations have sufficient access to legal expertise in the area of open data / open content	Int-2, Int-4, Int-7
Skills	Researchers need to become data-savvy	**(φ)** Int-3, Int-5, Int-6, Int-8, Int-10, Int-12, Int-14
	Network participants need to learn what linked data is about	Int-5, Int-6, Int-11
	Network participants need to learn how to use and publish linked data	Int-3, Int-8, Int-16
	Staff at theatre institutions need to acquire the know-how how to structure and to set up an archive	Int-1, Int-2, Int-7
	Staff at theatre institutions need to acquire legal expertise (copyright and privacy concerns)	Int-2, Int-11

4.2 Key findings from the empirical case

4.2.1 Data sharing

The main preoccupation of the interviewees pertaining to the *data sharing* cluster were the impediments caused by intellectual property rights – an aspect that is not prominent in the literature on data ecosystems. Both theatre organizations and heritage institutions hold a lot of relevant content that cannot be shared online due to copyright issues, which tend to be complex, making rights clearance rather onerous. Furthermore, the standard contracts in the sector are usually too restrictive to allow for the broad sharing of content. Organizations thus have yet to **overcome the impediments caused by intellectual property rights with regard to the sharing of content[β].**

The sharing of theatre metadata (e.g. performance histories) as open data, on the other hand, is not so much a rights issue, but more an issue of organizational capability and readiness. Here it is important that organizations **take a pro-active approach towards data management and data preservation[γ]**. The interviewees further pointed out that adoption of data sharing practices by organizations can be further accelerated by **having data stewards promote the sharing of data across the sector[ε]**.

4.2.2 Interoperability and shared infrastructures

To facilitate their participation in the ecosystem, organizations need to have **access to the adequate infrastructures and tools for the management of the data and content they hold[τ]**. This will often imply that **common tools and services for working with data need to be provided at the network level[μ]**, and that **synergies should be exploited by making use of shared digital infrastructures[υ]**. These aspects were more salient in the interviews than in the literature. Several interviewees pointed to the key role played by Wikidata in this area, not only in respect of the provision of a basic data infrastructure, but also in respect of the development and establishment of best practices regarding data publication. This is in line with earlier findings that Wikidata can be seen as complementary to national knowledge graphs for the performing arts and that efforts should therefore be undertaken to contribute to its population with performing arts related data (Estermann & Julien, 2019). Interestingly, as far as the technical infrastructure is concerned, the literature on data ecosystems lays a strong focus on the agreement on technical standards and the reuse of software, whereas the interviewees stress the importance of establishing common data infrastructures and tools which facilitate the

inclusion of network participants who currently do not have access to appropriate infrastructures.

As regards the establishment of shared data standards, the interviewees are in full agreement with the literature, stressing that it is important to establish **best practices and standards for harmonizing and integrating different data sources**[λ]. So far, the focus of the network has been on creating a shared model for information representation in the performing arts, and on making use of the same base registers and authority files. Here again, Wikidata has been playing an important role when it comes to developing a shared data model and to interlinking various base registers and authority files.

4.2.3 Stakeholder involvement

At the core of the *stakeholder involvement* cluster were measures aiming at the build-up of organizational capabilities and personal skills among staff members as well as aspects related to leadership and coordination. Almost half of the interviewees pointed to the fact that **specific change agents are needed to promote the intended change**[ν], with the goal to encourage arts organizations as well as heritage and research institutions specializing in the performing arts to take a pro-active approach towards data management and archiving. Related to the leadership function is the design of the ecosystem: Several interviewees stressed that **the data ecosystem should be designed in an inclusive manner**[α]. The focus should thereby not only be on involving organizations from Western countries but have a more international focus and also include stakeholders from the Global South. This call for inclusiveness at the international level is a feature that is typical for the LODEPA network and largely absent in the literature on data ecosystems, Jensen & Campbell (2019) being a noteworthy exception.

Besides coordination, e.g. in the form of best practices and guidelines, effective stakeholder involvement requires a set of technical skills (data management and preparation, data analysis, software development), access to technical infrastructures as well as organizational capabilities on behalf of the network participants. Accordingly, **organizations should ensure that their staff members have or acquire sufficient skills** in these areas[δ]. At the same time, measures should be taken at the network level to **make sure that organizations have access to qualified personnel (IT skills and domain expertise) to work on data management tasks**[ξ]. Measures to this effect may include

setting up training programs to promote skills building[π], **fostering peer learning**[σ], or **having third parties bring the necessary technical skills to network participants**[ρ].

4.2.4 Economic sustainability

The interviewees concurred with the findings from the literature that it is crucial to **secure the sustainability of the ecosystem by ensuring that those who make important contributions to it also experience its benefits**[i,η,θ] . The network is expected to be instrumental in securing the necessary funding for the establishment of a linked open data ecosystem where all resources are interconnectable and interoperable. Several interviewees stressed the fact that the establishment of LODEPA will require substantial financial resources, and that **the institutional funding situation of theatres and academic collections needs to be improved**[ι] to allow them to participate in the network. Several interviewees pointed to the importance of **dedicated project funding**[η] by governments and/or charities. Considering that obtaining the necessary funds is not always feasible, working with volunteers can be the next best option for some organizations to progress despite a lack of funding.

5 Discussion

5.1 Insights gained from the practical application of the framework

There are many overlaps between the insights gathered from the literature and the findings from the interviews. Notably, the sub-categories derived from the two, separately run analyses could readily be organized in the same four clusters (cornerstones of good ecosystem governance). In two instances, however, the interviewees drew attention to challenges that have not been extensively covered by the literature:

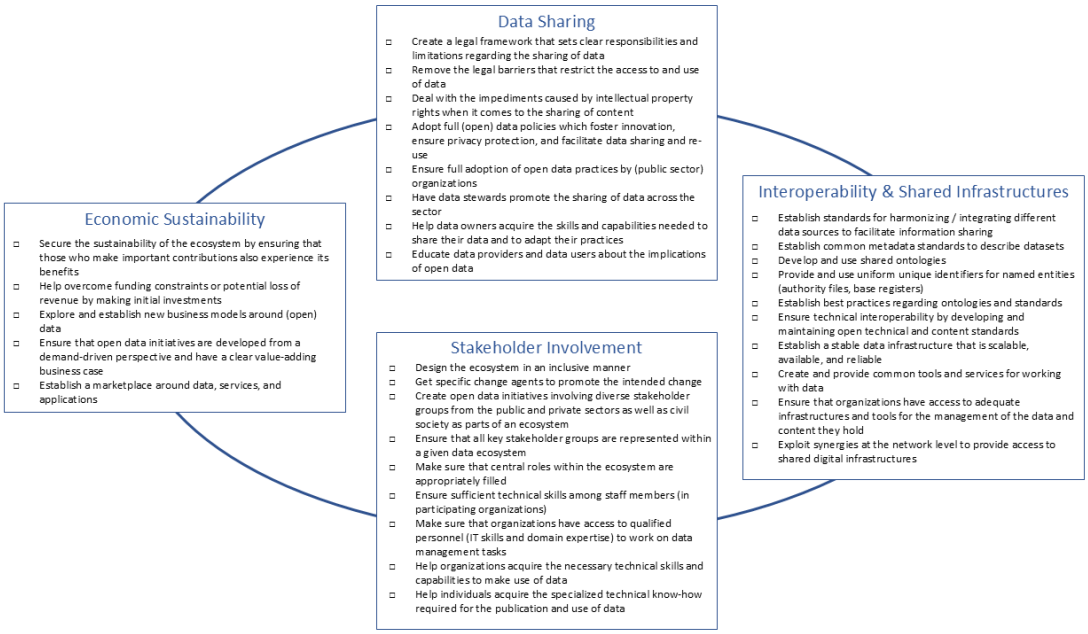
First, in contrast to the literature on data ecosystems, where copyrighted content is largely absent from the discussion, in the LODEPA case, content (photographs, audio-visual recordings, trailers, reviews, etc.) is at the core of the envisioned digital ecosystem, which is why issues related to copyright and neighbouring rights are among the main concerns of network members.

Second, the LODEPA case particularly sheds light on the dynamics during the build-up phase of a data ecosystem: The development of skills and capabilities among participants plays a major role during this phase, along with concerns regarding the resource situation, as institutional budgeting typically does not sufficiently anticipate

contributions to and benefits derived from the common infrastructure, which calls for targeted interventions by governments or charities, acting as catalysts for change during this early phase of ecosystem development. Also, interviewees have been sensitive to issues of exclusion, including the challenge of international inclusiveness, due to the generally fragile resource situation of many stakeholders. These aspects have been much more salient in the interviews with network participants than in the literature.

Thus, the LODEPA network is well-advised to continue using the ecosystem metaphor to lead the digital transformation in the performing arts sector, drawing both on the analytical framework derived from the literature and the analysis derived from the interviews. For this purpose, the key findings of our research have been summarised in the form of a set of checklists for good data ecosystem governance (Fig. 1).

Fig. 1. The four cornerstones of good data ecosystem governance (with checklists)



As the comparison of the insights from the literature with the empirical case has shown, different aspects may be salient in different contexts or become salient over time. It is therefore advisable to use the framework in an open-minded and iterative manner. Furthermore, in practical settings, the framework should be applied in a way that balances the need to focus on a limited set of aspects at a time with a more holistic view of ecosystem governance that is critical for the long-term success of the ecosystem. In doing so, the insights from systems thinking should be applied, e.g. by using a systemic impact

analysis to select the aspects to focus on at a given point in time (Ninck et al., 2014). If these caveats are applied, the proposed framework is a valuable instrument for leading the digital transformation in a variety of areas where data and information systems play an important role. Thus, it can for example be used to analyse the current state of implementation of a digital ecosystem and guide the development of an action plan based on this initial analysis in direct collaboration with key stakeholders.

5.2 The strengths of ecosystems-oriented analytical frameworks

For more than two decades, practitioners and researchers have tried to capture the development trends in e-government in the form of maturity models, or so-called stages-of-growth models, providing organizations with an idea of the development path ahead (Estermann, 2018). Similarly, international bodies have provided governments with benchmarks and/or common orientation frameworks as regards the current and future development of e-government (e.g. UN, 2020, 2018, 2016, etc.; OECD, 2021, 2019, 2017, etc.; European Union, 2017). While stages-of-growth models, benchmarks, and common orientation frameworks have been successfully used for sense-making and leading change in the field of e-government, they have their limitations and do not cover all the needs of change management. As has been pointed out, stage models often lack indications as to the capabilities needed by organizations to evolve from one stage to the other (Chen et al., 2011; Kim & Grant, 2010; Klievink & Janssen, 2009), or they turn a blind eye on their implications regarding business-IT alignment (Davison, Wagner, & Ma, 2005). As the analysis has shown, leading change based on a shared vision of the ecosystem can help overcome some of these limitations. It has been demonstrated how the ecosystem approach can be used to focus attention on the skills and capabilities needed for the envisioned transformation and to highlight the implications regarding business-IT alignment, including the necessary adaptations to legal provisions and political priorities. But first and foremost, the ecosystem metaphor lays the focus on inter-organizational collaboration which is a prerequisite for the successful transition to later stages of e-government development, characterized by collaborative or adaptive governance. The proposed framework is therefore particularly valuable in contexts where effective leadership requires a shared vision of the target system, the network of stakeholders, the governance issues that need to be resolved, as well as the personal skills and organizational capabilities required for the establishment of the target system.

5.3 Known limitations

The proposed framework nevertheless comes with two important limitations that should be kept in mind when applying it in research or practice: First, the proposed checklists for good data ecosystem governance represent a snapshot in time: Both the published literature and the stakeholder interviews, which served as the foundations of the framework, are the product of their time and the given context. While the literature has been strongly influenced by the early years of the open data movement, the interviews reflect the stakeholder views with regard to an empirical case where the ecosystem in question was in an early stage of development. Second, as the analysis of the empirical case has shown, depending on the thematic focus of a data ecosystem, aspects may be salient that may not be well represented in the literature.

As anecdotal evidence suggests, the open data movement is currently increasingly shifting its focus on sharing data that is potentially problematic in terms of access and control. Examples include the operationalization of digital self-determination (Verhulst, 2023) or the implementation of the "CARE Principles for Indigenous Data Governance", which stress the importance of gearing data use towards "collective benefit", insist on the "authority to control" by the people concerned by the data, and call for a respectful and inclusive approach, taking into account power differentials and historical contexts (Carroll et al, 2021). Furthermore, a lot of valuable data cannot readily be shared due to privacy concerns. As a result, arrangements are sought that allow for the sharing of such data – either by granting access to controlled environments only to a selected few and/or by using elaborate methods of data anonymization and aggregation. Another topic that has increasingly received attention over the past few years is the use of artificial intelligence – not only as regards its regulation, but also more generally, as regards its socio-economic impact, which may lead to changes in data sharing behaviour. Apart from technical implementation challenges, these developments mainly raise ethical questions and point to the need to create adequate policy frameworks and organizational arrangements.

As regards the empirical case, it particularly sheds light on the dynamics during the build-up phase of a data ecosystem: The development of skills and capabilities among participants plays a major role during this phase. Furthermore, there are strong concerns regarding the resource situation, as institutional budgeting typically does not sufficiently anticipate contributions to and benefits derived from the common infrastructure. During later phases of data ecosystem development, other aspects may become more salient.

While the chosen methodological approach, combining a literature analysis with the analysis of an empirical case, has certainly contributed to the robustness of the framework,

we cannot pretend to its exhaustiveness. Therefore, whenever the framework is applied in a specific setting – be it in research or in a practical setting – the methods employed should leave sufficient room for the emergence of new topics that may be particularly salient in a given context. As the analysis of the practical case has demonstrated, the 10 analytical categories the model rests upon leave ample room for additional topics to emerge and lend themselves well to highlighting the preoccupations present among stakeholders of a given data ecosystem at a given point in time.

6 Conclusion

As pointed out in the introduction, the digital transformation has a tremendous impact on the way public sector organizations operate, calling for a new paradigm in public sector governance. Against this backdrop, we have demonstrated how the ecosystem metaphor can be used as a tool for leading change in a complex and evolving environment. Unlike other tools for leading change, it accounts for the interdependency of social, technological and information systems and stresses their self-organizing and co-evolutionary character (cf. Nardi & O'Day, 1999).

Drawing on a synthesis of the current literature on data ecosystems as well as on stakeholder interviews from an empirical case, an analytical framework has been developed and synthesized in the form of four checklists for good data ecosystem governance. It allows practitioners and researchers alike to draw on the collected insights on this topic that have hitherto been published in the research literature. In contrast to governance frameworks which focus on developing or assessing national or municipal open government data initiatives (cf. Welle Donker & Van Loenen, 2017; Bonina & Eaton, 2020), the proposed analytical framework is geared towards thematic data ecosystems at an international level.

Based on a discussion of its advantages and limitations, it is suggested that the ecosystem approach, along with the analytical framework provided in this paper, be used to lead the digital transformation in a variety of thematic areas, making minor adjustments where appropriate.

7 Acknowledgements

I would like to express my gratitude to the LODEPA network members who have participated in the research as interview partners and provided valuable information about their respective organizations. I would also like to thank my former colleagues at the Bern University of Applied Sciences Flurina Wäspi and Nicolai Wenger for carrying out the interviews. Furthermore, I am grateful to Aline Stoll from the Zurich University of Applied Sciences for her reflections on organizational capabilities and ambidexterity of organizations and to Marijn Janssen and Bram Klievink for their helpful feedback on an earlier version of the paper. Last but not least, I would like to thank the two anonymous reviewers for their valuable comments.

8 Declaration of Conflicting Interests

Possible conflicts of interest associated with this publication have been made transparent in the author bio.

9 Funding

The author received no financial support for the research, authorship, and/or publication of this article.

10 Supplemental Material

Supplemental material for this article is available online (https://doi.org/10.5281/zenodo.17584935).

11 References

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of public administration research and theory*, *18*(4), 543-571.

Bonina, C., & Eaton, B. (2020). Cultivating open government data platform ecosystems through governance: Lessons from Buenos Aires, Mexico City and Montevideo. *Government Information Quarterly*, *37*(3).

Bourne, P. E., Lorsch, J. R., & Green, E. D. (2015). Perspective: Sustaining the big-data ecosystem. *Nature*, *527*(7576), S16-S17.

Brunner, R. D. (2010). Adaptive governance as a reform strategy. *Policy sciences*, *43*(4), 301-341.

Chen, J., Yan, Y., & Mingins, C. (2011, November). A three-dimensional model for egovernment development with cases in China's regional e-government practice and experience*, 2011 International Conference on Management of e-Commerce and e-Government (ICMeCG)* (pp. 113–120), IEEE.

Carroll, S. R., Herczog, E., Hudson, M., Russell, K., & Stall, S. (2021). Operationalizing the CARE and FAIR Principles for Indigenous data futures. *Scientific Data*, *8*(1), 108.

Collis, D. J. (1994). Research note: how valuable are organizational capabilities? *Strategic management journal*, *15*(S1), 143-152.

Davies, T. (2012). Open Data: infrastructures and ecosystems. *WebSci '12*.

Davison, R. M., Wagner, C., & Ma, L. C. (2005). From government to e-government: A transition model. *Information Technology and People, 18*(3), 280–299.

Dawes, S. S., Vidiasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, *33*(1), 15–27. https://doi.org/10.1016/j.giq.2016.01.003

Deloitte (2012). *Open Data driving growth, ingenuity and innovation*. Deloitte analytics paper.

Dunleavy, P., & Margetts, H. (2015). *Design principles for essentially digital governance.* Paper presented at the 111th Annual Meeting of the American Political Science Association, 3-6 September 2015.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New public management is dead—long live digital-era governance. *Journal of public administration research and theory*, *16*(3), 467-494.

Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory, 22*(1): 1-29.

Estermann, B. (2018). Development Paths Towards Open Government – An Empirical Analysis Among Heritage Institutions, *Government Information Quarterly, 35*(4), 599-612.

Estermann, B. (2020). Creating a Linked Open Data Ecosystem for the Performing Arts (LODEPA), *Arti dello Spettacolo / Performing Arts, Year 6, Special Issue*, pp. 31-49.

Estermann, B., Fraefel, M., Neuroni, A., & Vogel, J. (2018). Conceptualizing a National Data Infrastructure for Switzerland, *Information Polity, 23(1)*, 43-65.

Estermann B., & Julien, F. (2019). *A Linked Digital Future for the Performing Arts: Leveraging Synergies along the Value Chain*. Canadian Arts Presenting Association (CAPACOA) in cooperation with the Bern University of Applied Sciences.

European Union (2017). *Tallinn Declaration on eGovernment*. Tallinn, 6 October 2017.

Gama, K., & Lóscio, B. F. (2014). Towards Ecosystems based on Open Data as a Service. *ICEIS (2)*, *10*.

Gupta, A., Panagiotopoulos, P., & Bowen, F. (2020). An orchestration approach to smart city data ecosystems. *Technological Forecasting and Social Change*, *153*.

Hall, W., Shadbolt, N., Tiropanis, T., O'Hara, K., & Davies, T. (2012). *Open data and charities.* Oxford: Nominet Trust.

Harrison, T. M., Pardo, T. A., & Cook, M. (2012). Creating open government ecosystems: A research and development agenda. *Future Internet*, *4*(4), 900-928.

Heimstädt, M., Saunderson, F., & Heath, T. (2014). From Toddler to Teen: Growth of an Open Data Ecosystem. *JeDEM - EJournal of EDemocracy and Open Government*, *6*(2), 123–135.

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288.

Huvila, I. (2009). Ecological framework of information interactions and information infrastructures. *Journal of Information Science*, *35*(6), 695-708.

Huxham, C., Vangen, S., Huxham, C., & Eden, C. (2000). The challenge of collaborative governance. *Public Management an International Journal of Research and Theory*, *2*(3), 337-358.

Immonen, A., Palviainen, M., & Ovaska, E. (2014). Requirements of an open data based business ecosystem. *IEEE access*, *2*, 88-103.

Inan, G. G., & Bititci, U. S. (2015). Understanding organizational capabilities and dynamic capabilities in the context of micro enterprises: a research agenda. *Procedia-Social and Behavioral Sciences*, *210*, 310-319.

Janssen, M., & Van Der Voort, H. (2016). Adaptive governance: Towards a stable, accountable and responsive government. *Government Information Quarterly, 33*(1), 1-5.

Jensen, D. & Campbell, J. (2019) *The Case for a Digital Ecosystem for the Environment*. Discussion Paper. UN Environment Programme.

Jetzek, T. (2017). Innovation in the Open Data Ecosystem: Exploring the Role of Real Options Thinking and Multi-sided Platforms for Sustainable Value Generation through Open Data. In: Carayannis, E. G., & Sindakis, S. (eds.) (2017). *Analytics, Innovation, and Excellence-Driven Enterprise Sustainability*, Palgrave Macmillan, US, (pp. 137–168).

Khan, M. H. (2019). Knowledge, skills and organizational capabilities for structural transformation. *Structural Change and Economic Dynamics*, *48*, 42-52.

Kim, D. Y., & Grant, G. (2010). E-government maturity model using the capability maturity model integration. *Journal of Systems and Information Technology, 12*(3), 230–244.

Kitchenham, B. (2004). Procedures for Performing Systematic Reviews. Joint Technical Report. Keele University, UK / National ICT Australia Ltd, ISSN:1353-7776.

Kitchenham, B., Brereton, O. P., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering–a systematic literature review. *Information and software technology, 51*(1), 7-15.

Kitsios, F., Papachristos, N., & Kamariotou, M. (2017, July). Business models for open data ecosystem: Challenges and motivations for entrepreneurship and innovation. In *2017 IEEE 19th Conference on Business Informatics (CBI)* (Vol. 1, pp. 398-407). IEEE.

Klievink, B., & Janssen, M. (2009). Realizing joined-up government—Dynamic capabilities and stage models for transformation. *Government Information Quarterly, 26*(2), 275–284.

Klievink, B., van der Voort, H., & Veenema, W. (2018). Creating value through data collaboratives. *Information Polity, 23*, 379–397.

Klijn, E.-H. (2008). Governance and governance networks in Europe: An assessment of ten years of research on the theme. *Public Management Review, 10*(4), 505‑525.

Kontokosta, C. E. (2013). Energy disclosure, market behavior, and the building data ecosystem. *Annals of the New York Academy of Sciences*, *1295*(1), 34-43.

Kuipers, B. S., Higgs, M., Kickert, W., Tummers, L., Grandia, J., & Van der Voet, J. (2014). The management of change in public organizations: A literature review. *Public administration, 92*(1), 1-20.

Lindman, J., Kinnari, T., & Rossi, M. (2016). Business roles in the emerging open-data ecosystem. *IEEE Software*, *33*(5), 54-59.

Lnenicka, M., & Komarkova, J. (2019). Big and open linked data analytics ecosystem: Theoretical background and essential elements. *Government Information Quarterly*, *36*(1), 129–144.

Margetts, H., & Dunleavy, P. (2013). The second wave of digital-era governance: a quasi-paradigm for government on the Web. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(1987).

Marti M., Estermann, B., & Neuroni, A. (2022). „Die Tallinn-Prinzipien als Wegbereiter der digitalen Transformation des öffentlichen Sektors in der Schweiz". In: Mertes, A., & Pleger L.E. (eds.) (2022). Digitale Transformation der öffentlichen Verwaltung in der Schweiz. Wiesbaden: Springer Gabler.

Martin S., Turki S., & Renault S. (2017). Open Data Ecosystems. Introducing the Stimulator Function. In: Kő, A., & Francesconi E. (eds) (2017). Electronic Government and the Information Systems Perspective. EGOVIS 2017. *Lecture Notes in Computer Science, vol 10441*. Springer, Cham.

Masuzzo, P., & Martens, L. (2015). An open data ecosystem for cell migration research. *Trends in cell biology*, *25*(2), 55-58.

Maulana, R. Y., & Dečman, M. (2023). Collaborative Governance in the Digital Transformation Age: A Systematic Literature Review with Bibliometric Mapping. *Cent. Eur. Pub. Admin. Rev.*, *21*, 31.

McCallum E., Weicht R., McMullan L., & Price A. (2018). EntreComp into Action: get inspired, make it happen (Bacigalupo, M., & W. O'Keeffe, W., eds.), EUR 29105 EN, Publications Office of the European Union, Luxembourg.

Nardi, B., & O'Day, V. (1999). *Information Ecologies: Using Technology with Heart*. MIT Press.

Ninck, A., Burki, L., Hungerbuehler, R., & Muhlemann, H. (2014). *Systemics: Viable Solutions for complex challenges.* (Heuris publishing).

OECD (2017). Government at a Glance 2017. OECD. https://doi.org/10.1787/gov_glance-2017-en

OECD (2019). Government at a Glance 2019. OECD. https://doi.org/10.1787/8ccf5c38-en

OECD (2021). Government at a Glance 2021. OECD. https://doi.org/10.1787/1c258f55-en

Petticrew, M., & Roberts, H. (2008). *Systematic reviews in the social sciences: A practical guide.* John Wiley & Sons.

Poikola, A., Kola, P., & Hintikka, K. A. (2011). Public data. *An introduction to opening information sources.* Helsinki, Finland: Ministry of Transport and Communications.

Pollock, R. (2011). *Building the (Open) Data Ecosystem – Open Knowledge Foundation Blog*. https://blog.okfn.org/2011/03/31/building-the-open-data-ecosystem/ (retrieved: 30.09.2021).

Ponte, D. (2015). *Enabling an open data ecosystem*. ECIS 2015 Research-in-Progress Papers. Paper 55. ISBN 978-3-00-050284-2. http://aisel.aisnet.org/ecis2015_rip/55 (retrieved: 21.02.2022).

Styrin, E., Luna-Reyes, L. F., & Harrison, T. M. (2017). Open data ecosystems: an international comparison. *Transforming Government: People, Process and Policy*, *11*(1), 132–156.

Ubaldi, B. (2013). Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives. *OECD Working Papers on Public Governance*, *NO.22*(22), 61.

UN (2016). *United Nations E-Government Survey 2016. E-Government in support of Sustainable Development.* United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/205.

UN (2018). *United Nations E-Government Survey 2018. Gearing E-Government to Support Transformation Towards Sustainable and Resilient Societies.* United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/212.

UN (2020). *United Nations E-Government Survey 2020. Digital Government in the Decade of Action for Sustainable Development. With Addendum on COVID-19 Response.* United Nations Department of Economic and Social Affairs. ST/ESA/PAD/SER.E/214.

van Donge, W., Bharosa, N., & Janssen, M. F. W. H. A. (2022). Data-driven government: Cross-case comparison of data stewardship in data ecosystems. *Government Information Quarterly*, *39*(2).

Van Schalkwyk, F., Willmers, M., & McNaughton, M. (2016). Viscous open data: The roles of intermediaries in an open data ecosystem. *Information Technology for Development*, *22*(sup1), 68-83.

Van Wart, M. (2003). Public-sector leadership theory: An assessment. *Public administration review*, *63*(2), 214-228.

Verhulst, S. G. (2023). Operationalizing digital self-determination. *Data & Policy*, *5*, e14.

Vogel, R., & Masal, D. (2015). Public leadership: A review of the literature and framework for future research. *Public Management Review, 17*(8), 1165-1189.

Wang, C., Medaglia, R., & Zheng, L. (2018). Towards a typology of adaptive governance in the digital government context: The role of decision-making and accountability. *Government Information Quarterly*, *35*(2), 306-322.

Welle Donker, F., & van Loenen, B. (2017). How to assess the success of the open data ecosystem? *International Journal of Digital Earth*, *10*(3), 284-306.

Wright, B. E., Moynihan, D. P., & Pandey, S. K. (2012). Pulling the levers: Transformational leadership, public service motivation, and mission valence. *Public administration review, 72*(2), 206-215.

Zuiderwijk, A., Janssen, M., & Davis, C. (2014). Innovation with open data: Essential elements of open data ecosystems. *Information Polity*, *19*(1–2), 17–33. https://doi.org/10.3233/IP-140329

12 Author Biography

Beat Estermann holds a doctorate degree in Public Administration of the University of Bern as well as master's degrees in Public Management and in Translation Studies of the University of Geneva. From 2007 to 2022 he worked at the Institute for Public Sector Transformation (formerly E-Government Institute) of the Bern University of Applied Sciences – from 2019 onwards as a professor and between 2019 and 2021 as the deputy head of the institute. Between 2023 and 2024, he coordinated the Bern Academy of the Arts' activities in the area of Open Science and the Digital Humanities. His research interests focus on topics related to the digital transformation of society and public sector organizations. He is currently self-employed, providing research and consulting services related to the digital transformation.

As regards his civil-society engagement, he is a founding member of the association Opendata.ch: Between 2013 and 2025 he coordinated the association's OpenGLAM working group which advocates for open data and participatory approaches among memory institutions. From 2018 to 2024, he served on the association's board. In 2023, he started a new working group dedicated to the promotion of Open Event Data. Together with the director of research and development of the Canadian Association for the Performing Arts (CAPACOA), he coordinates an international multi-stakeholder network dedicated to the establishment of a digital ecosystem for the performing arts, based on linked data technology. From 2015 to 2018, he chaired the eCH specialist group "Open Government Data", which is dedicated to standardization issues around Open Government Data in Switzerland.

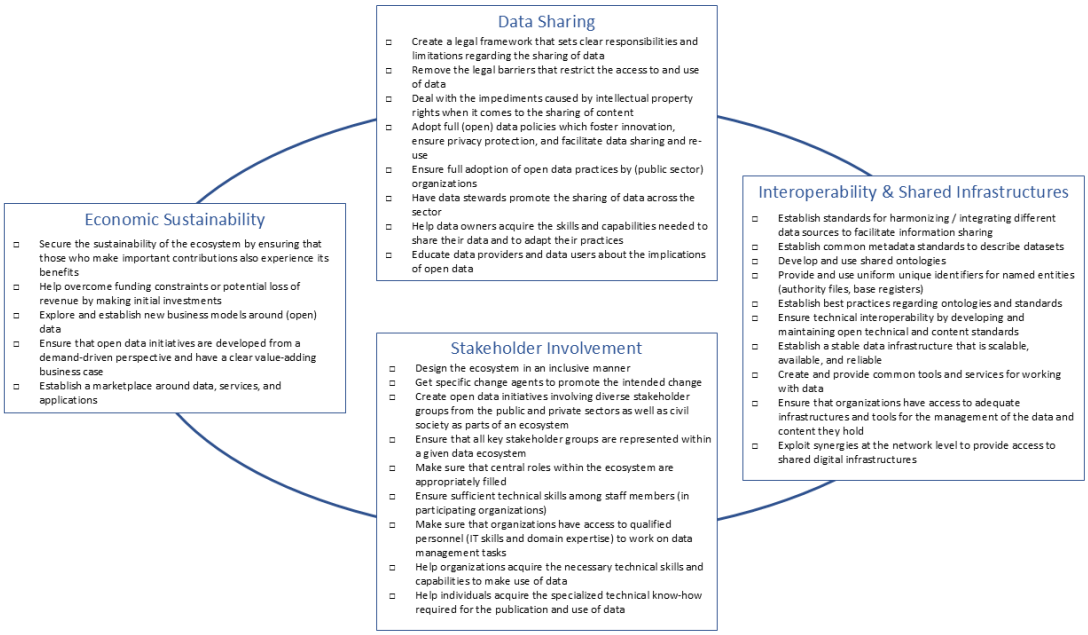
2.3.1 Appendix

Supplementary Material Published on Zenodo (https://zenodo.org/records/17584935)

Supplementary Material

The appendix contains further elements illustrating the methodological approach as described in the article. As pointed out in the article, the ecosystem approach and the proposed framework are particularly useful to lead the digital transformation in areas where data and information systems play an important role. At the difference of frameworks that focus on ecosystems around national data portals, the proposed analytical framework is geared towards the development of thematic data ecosystems at an international level. Thus, it can for example be used to analyse the current state of implementation of a digital ecosystem and guide the development of an action plan based on this initial analysis in direct collaboration with key stakeholders. To do so, we suggest to proceed iteratively – both as regards the delimitation of the ecosystem, its analysis, and the progressive involvement of additional stakeholders.

Fig. 1. The four cornerstones of good data ecosystem governance (with checklists)



Analysts may proceed according to the following step-by-step process:

1. Carry out desk research to identify the existing elements, the main purposes, and the key stakeholders of a given thematic ecosystem; provide an initial description of the ecosystem, addressing its four cornerstones: (i) data sharing; (ii) interoperability and shared infrastructures; (iii) stakeholder involvement; and (iv) economic sustainability. This can be done using the check lists provided in the article (fig. 1). Be careful to differentiate between areas where further ecosystem development is needed, and areas on which information is still lacking. Try filling in the knowledge gaps by talking to a few key informants familiar with the ecosystem or by carrying out a workshop among ecosystem participants.

   Critical at this stage is the initial delimitation of the thematic ecosystem: If the ecosystem under consideration is too large (e.g. "environmental data ecosystem" versus "biodiversity data ecosystem"), it will require a comparatively larger effort to capture it as a whole and subsequently to lead its development; if it is too small (e.g. "biodiversity data ecosystem for the Republic of Ireland" vs. "global biodiversity data ecosystem"), important synergy potentials may be missed.

2. Carry out expert interviews with representatives of all key stakeholders of the ecosystem, using an adapted version of the questionnaire provided below (A1). For the purpose of the analysis, identify all the passages that address governance and/or coordination issues, and assign them to one or several of the categories provided in the check lists. If additional topics are salient in the interviews, add them as additional categories. Summarize the findings in a report.

   The report may highlight the aspects that are in focus among the ecosystem

participants at a given point in time and point to possible gaps with regard to good ecosystem governance by comparing them to the status quo of the ecosystem and to the check lists.

3. Develop an action plan for the development of the digital ecosystem in direct cooperation with key stakeholders. Regularly track the progress of its implementation.

Iterate any of the three steps whenever deemed useful, triangulating between the different approaches of data collection.

A1. Interview Questionnaire Used for the Expert Interviews

In view of the creation of a Linked Open Data Ecosystem for the Performing Arts, [name of the institution] is interviewing key stakeholders to find out what their view is on issues related to the development of staff skills and organizational capacities. Furthermore, we are interested in learning about governance issues that should be addressed in view of the establishment and exploitation of the linked open data ecosystem.

The interviews will be recorded. Confidentiality of the responses is ensured. The interview protocols will be sent to the interviewees for double-checking.

Questions in **bold** *are to be asked of all interviewees. The answers to the questions in* normal script *should become evident from the responses; if not, ask these questions specifically. Further instructions to interviewers are in italics.*

Description of the type of organization
Research in advance (see also the LODEPA partner data template) and double check with the interviewee at the beginning of the interview.

What is *your role* within your organization?

What role does data play for your organization?
In the case of umbrella organizations: ask also with regard to their member organizations (this applies to all questions regarding "your organization").

Does your organization exchange data with other organizations?
In the case of umbrella organizations: ask also with regard to their members.

- **What data do you receive?**
- **What data do you share with others?**

Does your organization make data available for a broader public?
In the case of umbrella organizations: ask also with regard to their members.

- **What are the target groups**

How does the sharing/exchanging of data across organizational boundaries or with the broader public take place today? And how could it take place in the future?

- Is your organization likely to share some of its data as open data?
- Is your organization likely to rely on other parties to help maintaining the data it requires to carry out its business?
- Is your organization likely to use online communities, crowdsourcing or expert sourcing approaches to help it maintain the data it requires to carry out its business?

What would be the benefits of this new arrangement for your organization?

Have you heard about the Linked Open Data Ecosystem for the Performing Arts?

- **If yes: What do you think about it? What would be the upsides / downsides for your organization? Do you see any particular challenges?**

When you think about the way your organization, its partners and audiences will use, exchange and share data in the future: What extra skills would your staff members require for this?

- **Do you think it would be easy for your staff to acquire the required skill set? Or for your organization to hire the staff with the right skills?**

- What are the skills that are most critical / hardest to acquire?

… What extra capacities would your organization require? (e.g. technical, organizational capacities)

… What are the extra staff skills and organizational capacities required by the organizations you are closely cooperating with?

Are there any skills or capacities that should rather be built up at the level of the network or the community instead of building them up within every single organization?

- **What skills and capacities would your organization like to provide to the network/community?** To which (type of) organizations specifically? What are their needs?
- **What skills and capacities would your organization like to receive from the network/community?** From which (type of) organization specifically? What are your organization's specific needs?
- What aspects should be given the highest priority when it comes to building up skills/capacities at the network/community level?

When you think about the way your organization will exchange and share data with others in the future, are there any current rules that should be adapted? Are there any new policies or regulations that should be put in place? Any rights to be defined differently? Which ones?

Do you think the culture of working together should be changed? In what ways?

- **What is needed to make this cultural change happen?**
- **Whom do you perceive as the major change agents to make this cultural change happen?** What do they do? How do they proceed?

We have reached the end of the questionnaire. Do you have any further remarks?

Thank you very much for your inputs!

A2. Generation of Sub-categories (Ethical Dimension)

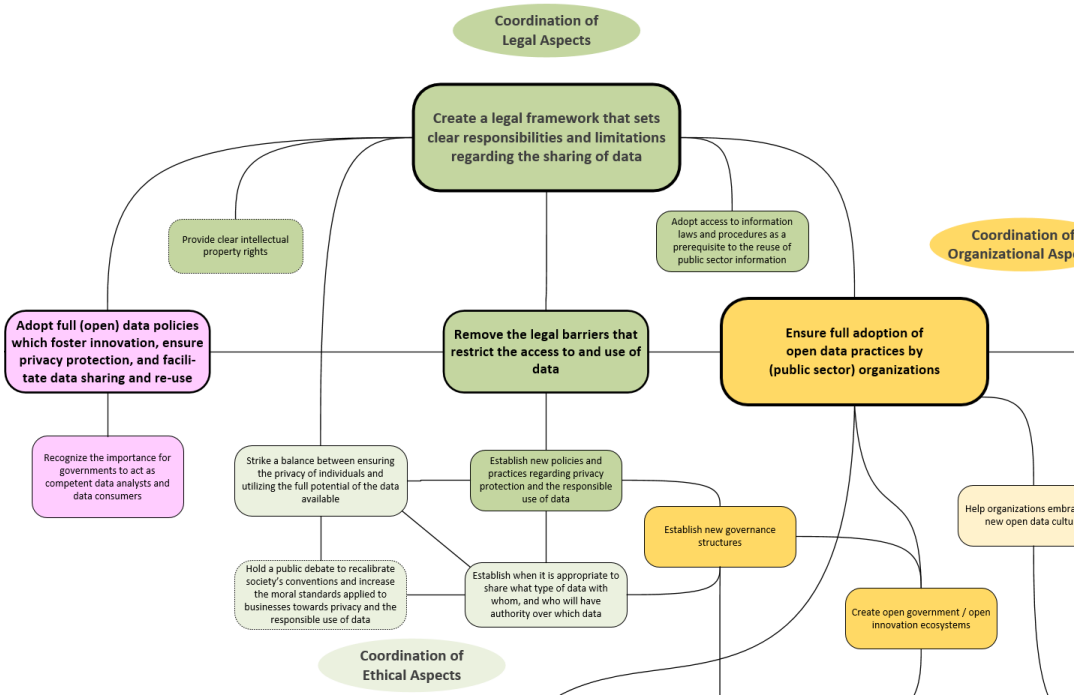
From the text passages associated with a given dimension during the initial categorization (using Atlas.ti), relevant discursive elements were extracted and condensed into sub-categories. The example shown below (ethical dimension, discursive elements from text passages in the literature) is a dimension with comparatively few text passages / sub-categories. Note that sub-categories with discursive elements / text passages from only one source were removed from the further analysis.

Sub-categories / Discursive Elements from Text Passages	**Sources**
Strike a balance between ensuring the privacy of individuals and utilizing the full potential of the data available	Jensen & Campbell (2019) Jetzek (2017) Kontokosta (2013) Lnenicka & Komarkova (2019) Ubaldi (2013)
Establish when it is appropriate to share what type of data with whom, and who will have authority over which data	Estermann (2020) Jensen & Campbell (2019) Harrison et al. (2012) Ubaldi (2013)
- Make data sharing a new norm in the social license of business to operate	Jensen & Campbell (2019)
- Establish independent ethics and governance groups to oversee policies and procedures for improving the use of administrative data	Ubaldi (2013)
Hold a public debate to recalibrate society's conventions and increase the moral standards applied to businesses towards privacy and the responsible use of data	Deloitte (2012) Hall et al. (2012)
- Hold wider discussions to identify risks, trade-offs, and the role that different organisations have in ensuring the privacy, security and trust of the individuals and communities they serve	Hall et al. (2012)
- Have all organisations take an active role in engaging citizens and customers in a conversation about the data	Deloitte (2012)
Establish core ethical principles and social values among coders, computers engineers and data scientists	Jensen & Campbell (2019)
- Establish an ethical protocol at the international level for coders, computer engineers and data scientists which countries and companies adopt and monitor	Jensen & Campbell (2019)
- Provide training and develop a culture of ethics among coders and data scientists	Jensen & Campbell (2019)
Increase the individual empowerment regarding the (re-)use of personal data	Deloitte (2012)
- Have organisations use the MiData charter to define clearly what data is collected, how it is used and what the benefits are to the individual and to the wider community	Deloitte (2012)
- Have organisations obtain citizens' and customers' informed and explicit consent regarding the use of their personal data	Deloitte (2012)
- Provide the necessary education to ensure that individuals and businesses understand the benefits and challenges of open data (the growing value of open data must go hand in hand with increasing levels of responsibility and governance on its availability and distribution)	Deloitte (2012)

Establish new agile governance models with an increased emphasis on ethics and values to guide technical development, as technological innovation moves faster than institutions	Jensen & Campbell (2019)
- Ensure that the implementation of a global ecosystem reflects agreed principles of international law and human rights	Jensen & Campbell (2019)
- Reach a thorough understanding of the implications of potential power imbalances and how they can be mitigated	Jensen & Campbell (2019)
- Establish a new social contract between companies, governments and citizens where mutual obligations and responsibilities are spelled out	Jensen & Campbell (2019)
- Reach a thorough understanding how companies can resolve potential conflicts of interest that might arise between their public mission of doing good together with the private mission of making money	Jensen & Campbell (2019)

A3. Representation of Sub-categories in a Graph

The image below shows an extract of the graph containing the sub-categories retained, weighted according to the number of sources. For the purpose of the analysis, mind-map like connections were made between the different sub-categories. The extract shows the legal and the ethical aspects extracted from the literature, as well as some of the sub-categories belonging to the political and the organizational dimensions.



A4. Sub-categories retained, organized in four clusters

Cluster	Dimension	Sub-category	Sources / Interviews *(Remarks)*
Data Sharing	Legal	Create a legal framework that sets clear responsibilities and limitations regarding the sharing of data	**(b)** Bonina & Eaton (2020); Dawes et al. (2016); van Donge et al. (2022); Harrison et al. (2012); Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kontokosta (2013); Lnenicka & Komarkova (2019); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Legal	Remove the legal barriers that restrict the access to and use of data	**(c)** Davies (2012); Heimstädt et al. (2014); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Lnenicka & Komarkova (2019); Ubaldi (2013)
	Legal	Deal with the impediments caused by intellectual property rights when it comes to the sharing of data and content	**(β)** Int-1, Int-4, Int-5, Int-8, Int-11, Int-12, Int-13
	Political	Adopt full (open) data policies which foster innovation, ensure privacy protection, and facilitate data sharing and re-use	**(d)** Bonina & Eaton (2020); Davies (2012); Dawes et al. (2016) ; Heimstädt et al. (2014); Jensen & Campbell (2019); Styrin et al. (2017); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Organizational	Ensure full adoption of open data practices by (public sector) organizations	**(h)** Bonina & Eaton (2020); Bourne et al. (2015); Davies (2012); Dawes et al. (2016); Gama & Loscio (2014); Harrison et al. (2012); Heimstädt et al. (2014); Jensen & Campbell (2019); Martin et al. (2017); Styrin et al. (2017); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Organizational	*Have organizations take a pro-active approach towards data management and archiving*	**(γ)** Int-1, Int-7, Int-8, Int-9, Int-10, Int-14, Int-15, Int-17 ***(subsumed under h)***
	Organizational	Have data stewards promote the sharing of data across the sector	**(ε)** Int-10, Int-14, Int-15, Int-17
	Organizational	*Have an institution coordinate the documenting and archiving of performing arts related material at a national level or at the level of a language region*	**(ζ)** Int-1, Int-2, Int-7, Int-8 ***(specific to LODEPA, subsumed under h)***
	Organizational Capabilities	Help data owners acquire the skills and capabilities needed to share their data and to adapt their practices	**(w)** Dawes et al. (2016); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Skills	Educate data providers and data users about the implications of open data	**(y)** Deloitte (2012); Gupta et al. (2020); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Ubaldi (2013)
Interoperability & Shared Infrastructures	Semantic	Establish standards for harmonizing / integrating different data sources to facilitate information sharing	**(p)** Bonina & Eaton (2020); van Donge et al. (2022); Gama & Loscio (2014); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Klievink et al. (2018); Kontokosta (2013); Masuzzo & Martens (2015); Ubaldi (2013); Zuiderwijk et al. (2014)
	Semantic	Establish common metadata standards to describe datasets	**(o)** Bourne et al. (2015); Dawes et al. (2016); Hall et al. (2012); Harrison et al. (2012); Jensen & Campbell (2019); Masuzzo & Martens (2015); Ubaldi (2013)
	Semantic	Develop and use shared ontologies	**(q)** Davies (2012); Dawes et al. (2016); Estermann (2020); Hall et al. (2012); Kontokosta (2013); Ubaldi (2013); Zuiderwijk et al. (2014)
	Semantic	*Establish a shared ontology for the performing arts*	**(κ)** Int-2, Int-3, Int-4, Int-7, Int-11, Int-15, Int-16 ***(specific to LODEPA, subsumed under q)***
	Semantic	Provide and use uniform unique identifiers for named entities (authority files, base registers)	**(r)** Bourne et al. (2015) ; Estermann (2020) ; Hall et al. (2012) ; Kontokosta (2013) ; Ubaldi (2013) ; Zuiderwijk et al. (2014)
	Semantic	Establish best practices regarding ontologies and standards	**(λ)** Int-4, Int-7, Int-8, Int-14, Int-16, Int-17
	Technical	Ensure technical interoperability by developing and maintaining open technical and content standards	**(s)** Davies (2012) ; Dawes et al. (2016); Gama & Loscio (2014); Hall et al. (2012) ; Harrison et al. (2012) ; Immonen et al. (2014) ; Jensen & Campbell (2019) ; Lindman et al. (2016); Masuzzo & Martens (2015); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Technical	Establish a stable data infrastructure that is scalable, available and reliable	**(t)** Bonina & Eaton (2020) ; Davies (2012) ; van Donge et al. (2022) ; Gama & Loscio (2014) ; Kontokosta (2013) ; Lnenicka & Komarkova (2019) ; Ubaldi (2013)
	Technical	Create and provide common tools and services for working with data	**(u)** Bonina & Eaton (2020) ; Bourne et al. (2015); Davies (2012); Gama & Loscio (2014); Immonen et al. (2014) ; Jensen & Campbell (2019) ; Kitsios et al. (2017) ; Lnenicka & Komarkova (2019)
	Technical	*Develop and establish common data infrastructures and tools*	**(μ)** Int-1, Int-4, Int-5, Int-10, Int-11, Int-14 ***(subsumed under u)***
	Organizational Capabilities	Ensure that organizations have access to adequate infrastructures and tools for the management of the data and content they hold	**(τ)** Int-4, Int-5, Int-8, Int-11, Int-14
	Organizational Capabilities	Exploit synergies at the network level to provide access to shared digital infrastructures	**(υ)** Int-2, Int-8, Int-10, Int-14

Stakeholder Involvement	Ethical	Design the ecosystem in an inclusive manner	**(α)** Int-3, Int-7, Int-14, Int-16
	Leadership	Get specific change agents to promote the intended change	**(v)** Int-4, Int-5, Int-6, Int-8, Int-11, Int-12, Int-14, Int-17
	Organizational	Create open data initiatives involving diverse stakeholder groups from the public and private sectors as well as civil society as parts of an ecosystem	**(e)** Bonina & Eaton (2020); Davies (2012); Dawes et al. (2016); van Donge et al. (2022); Gama & Loscio (2014); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Klievink et al. (2018); Lnenicka & Komarkova (2019); Martin et al. (2017); Styrin et al. (2017); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Organizational	Ensure that all key stakeholder groups are represented within a given data ecosystem	**(f)** Bonina & Eaton (2020); Bourne et al. (2015); Dawes et al. (2016); Gama & Loscio (2014); Hall et al. (2012); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Kontokosta (2013); Lnenicka & Komarkova (2019); Masuzzo & Martens (2015); Styrin et al. (2017); Ubaldi (2013); Van Schalkwyk et al. (2016)
	Organizational	Make sure that central roles are appropriately filled within a given data ecosystem	**(g)** Bonina & Eaton (2020); Dawes et al. (2016); van Donge et al. (2022); Gupta et al. (2020); Harrison et al. (2012); Klievink et al. (2018); Van Schalkwyk et al. (2016)
	Organizational	Ensure sufficient technical skills among staff members	**(δ)** Int-1, Int-3, Int-4, Int-7, Int-12, Int-14, Int-16
	Organizational Capabilities	Help organizations acquire the necessary technical skills and capabilities to make use of data	**(v)** Dawes et al. (2016); Deloitte (2012); Gupta et al. (2020); Hall et al. (2012); Harrison et al. (2012); Jensen & Campbell (2019); Lnenicka & Komarkova (2019)
	Organizational Capabilities	Make sure that organizations have access to qualified personnel (IT skills and domain expertise) to work on data management tasks	**(ξ)** Int-1, Int-2, Int-8, Int-10, Int-11, Int-12, Int-14, Int-16, Int-17
	Organizational Capabilities	*Set up training programs to promote skills building*	**(π)** Int-3, Int-6, Int-8, Int-13, Int-14, Int-16, Int-17 ***(subsumed under ξ)***
	Organizational Capabilities	*Foster peer learning*	**(σ)** Int-3, Int-6, Int-8, Int-11, Int-13, Int-16 ***(subsumed under ξ)***
	Organizational Capabilities	*Have third parties bring the necessary technical skills to network participants*	**(ρ)** Int-2, Int-4, Int-7, Int-8, Int-10, Int-11, Int-17 ***(subsumed under ξ)***
	Skills	Help individuals acquire the specialized technical knowhow required for the publication and use of data	**(x)** Dawes et al. (2016); Deloitte (2012); Gupta et al. (2020); Hall et al. (2012); Jensen & Campbell (2019); Jetzek (2017); Lnenicka & Komarkova (2019); Ponte (2015); Ubaldi (2013); Welle Donker & van Loenen (2017)
	Skills	*Researchers need to become data-savvy*	**(φ)** Int-3, Int-5, Int-6, Int-8, Int-10, Int-12, Int-14 ***(specific to LODEPA, subsumed under x)***
Economic Sustainability	Economic	Secure the sustainability of the ecosystem by ensuring that those who make important contributions also experience its benefits	**(i)** Dawes et al. (2016); Estermann (2020); Gupta et al. (2020); Heimstädt et al. (2014); Immonen et al. (2014); Kitsios et al. (2017); Lindman et al. (2016); Lnenicka & Komarkova (2019); Martin et al. (2017); Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Economic	*Secure the necessary resources for data management and digitization*	**(η)** Int-3, Int-6, Int-8, Int-9, Int-11, Int-12, Int-17 ***(subsumed under i)***
	Economic	*Improve the institutional funding situation of theatres and academic collections*	**(ι)** Int-1, Int-7, Int-8, Int-10, Int-14 ***(specific to LODEPA, subsumed under i)***
	Economic	Help overcome funding constraints or potential loss of revenue by making initial investments	**(m)** Davies (2012); Dawes et al. (2016); van Donge et al. (2022); Gupta et al. (2020); Hall et al. (2012); Jetzek (2017); Lindman et al. (2016); Martin et al. (2017) Ubaldi (2013); Welle Donker & van Loenen (2017)
	Economic	*Secure the necessary project funding*	**(η)** Int-2, Int-3, Int-8, Int-9, Int-10, Int-11, Int-12, Int-13 ***(subsumed under m)***
	Economic	Explore and establish new business models around (open) data	**(j)** Bourne et al. (2015); Dawes et al. (2016); Estermann (2020); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Kitsios et al. (2017); Lindman et al. (2016); Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016); Welle Donker & van Loenen (2017)
	Economic	Ensure that open data initiatives are developed from a demand-driven perspective and have a clear value-adding business case	**(l)** Davies (2012); Dawes et al. (2016); Harrison et al. (2012); Jensen & Campbell (2019); Jetzek (2017); Kontokosta (2013); Martin et al. (2017) Ponte (2015); Ubaldi (2013); Van Schalkwyk et al. (2016)
	Economic	Establish a marketplace around data, services and applications	**(k)** Gama & Loscio (2014); Gupta et al. (2020); Harrison et al. (2012); Immonen et al. (2014); Jensen & Campbell (2019); Jetzek (2017); Martin et al. (2017) Ponte (2015)

Acknowledgements

First, I would like to thank all the people who have made it possible to develop and implement the Open GLAM Benchmark Survey:

- Daniel Felder, David Studer, and Markus Vogler for their help with the implementation of the Swiss Pilot Survey, as well as Doris Amacher, Barbara Fischer, André Golliez, Frank von Hagel, Alessia Neuroni, Hartwig Thomas, and David Vuillaume for helping to improve the first version of the questionnaire.
- The members of the Open Knowledge Foundation's Open GLAM Working Group, Joris Pekel, Maarten Brinkerink, Dorota Kawęcka, Sanna Mattila, Helene Hahn, Thomasin Sleigh, Lieke Ploeger, Subhashish Panigrahi, and Mariana Valente, for helping to launch the survey at the international level. Gemma Echevarria, Maria de Vallibana Serrano, Merete Sanderhoff, Laura Sillanpää, Gerhard Jan Nauta, Max Hammond, Laura Carletti, Alek Tarkowski, and Liliana Melgar for the further development of the questionnaire, as well as the many colleagues who helped translating it and rolling it out in their respective countries: Joris Pekel, Erwin Verbruggen, Laura Sillanpää, Katja Bargum, Pia Lonardi, Antti Pakarinen, Tove Orsted, Maria Virtanen, Leonard Kwuida, Fréderic Noyer, Helene Hahn, Sylvia Petrovic-Majer, Dorota Kawęcka, Aleksandra Janus, Anna Buchner, Vladislav Nedelev, Maria Valente, Helena Patricio, Margarida Lopes, Dulce Fontes, Anna Khrobolova, Bohdan Melnychuk, Ekaterina Estermann, Vadim Zaytsev, Vira Motorko, Bohdan Melnychuk, Oksana Brui, and Galyna Onysko.

Furthermore, I would like to thank the members of the LODEPA network who have served as interview partners and provided valuable information contributing to the research on the digital ecosystem for the performing arts. I am also very grateful to my former colleagues Flurina Wäspi and Nicolai Wenger for carrying out the interviews.

I am also very grateful to Marijn Janssen, who's support was instrumental in adapting papers 2 and 3 for the e-government research community, as well as to my thesis supervisor, Prof. Reto Steiner, for his insistence on going the extra mile of having the second paper published in a top-tier journal.

And finally, I would like to thank my supervisors and colleagues at the Bern University of Applied Sciences, namely Andreas Spichiger and Alessia Neuroni, for their trustful support and confidence that my dissertation would have an impact not only at the academic level, but also with regard to the communities of practice it addresses.

Short Biography of the Author

Beat Estermann holds master's degrees in Translation Studies and in Public Management of the University of Geneva. Since 2007 he has been working for the Bern University of Applied Sciences: until 2022 as a researcher and professor at the Institute for Public Sector Transformation, and since 2023 at the Bern Academy of the Arts, where he coordinates the art school's activities related to Open Science and the Digital Humanities. Besides that, he is self-employed, providing research and consulting services as well as training related to the digital transformation. He is a founding member of Opendata.ch, a non-profit association for the promotion of open data and open knowledge in Switzerland, where he is responsible for the activities related to cultural heritage and open event data. Together with Frédéric Julien of the Canadian Association for the Performing Arts (CAPACOA), he coordinates a network of people and organizations working towards the establishment of a Linked Open Data Ecosystem for the Performing Arts.

Statement of Autonomous and Independent Work

„Ich erkläre hiermit, dass ich diese Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe r des Gesetzes vom 5. September 1996 über die Universität zum Entzug des aufgrund dieser Arbeit verliehenen Titels berechtigt ist.“

Bern, den 15. Juni 2024

Beat Estermann