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# Museum Open Data Ecosystems: a comparative study

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## Abstract

**Purpose** – We investigate how, in forming their policy towards open data, art museums interact with the open data ecosystems they are part of, comprising internal and external components such as cultural policy, legal frameworks, user groups, and economic conditions and incentives.

**Design/methodology/approach** – We structure our research as a multiple case study based on three open data ecosystems, each defined by a mid-sized European art museum at its centre. Qualitative analysis of the case studies proceeds from interviews with museum management staff and policy-related agencies in three European countries, in addition to document analysis.

**Findings** – Our results suggest that museums are sensitive towards their environments and respond to their ecosystem based on what is communicated within their networks. However, museums are not effective in communicating with their users, limiting the informational interdependence necessary for well-functioning open data ecosystems. EU policy appears to be a driving force along with national financial incentives, though institutional conditions are limiting progress. Advancing the field relies instead on an epistemological shift to understand the museum as part of a larger information network.

**Originality/value** – As the first comparative case study of art museum open data ecosystems that we are aware of, the study provides a qualitative analysis of the complex dynamics impacting open data policy within the mid-sized art museum. We identify specific dynamics that are thus far restricting further development of the open data ecosystem of the mid-sized European art museum.

**Keywords** Open data, Museums, Ecosystems, Reuse, Networks, Cultural policy, Users

**Paper type** Research paper



## 1. Introduction

Art museums increasingly strive to be ‘open’ along with cultural, political, and museological ideals characterized by notions of transparency, collaborative processes and open access to culture (Dupuy, Juanals and Minel, 2015). Relevant in this regard is open data (OD), for which the basic premise is simple: A museum releases digitized collection data in formats and standards that permit varying levels of reuse by machines, intermediaries or human end-users. Illustrating openness permitting commercial reuse, games developer Ubisoft incorporated elements from the National Museum of Antiquities Leiden (NMoAL) in its Assassin’s Creed video game. Non-commercial reuse occurs when another museum accesses the NMoAL’s collection via the European OD aggregator, Europeana, to improve their own website offering.

Despite the potential of art related OD and linked open data (LOD), only a small percentage of digital museum collections qualify as OD using a broad definition of the term. Much museum related research has then focused on impediments to OD adoption, emphasizing pathways towards it, and a range of macro through micro exogenous variables that impact OD adoption. While important, supply-oriented research tends to overlook that the museum only fulfils a specific role in a longer value chain between cultural object and end-user, and that OD achieves societal value only through the interdependencies and feedback generated by a range of systems and stakeholders, i.e., through actual use (Janssen, Charalabidis and Zuiderwijk, 2012).

With a modest number of quantitative studies on open museum data, there are few qualitative international comparative studies (Estermann, 2014, 2016), and little research on the dynamics of complex macro factors such as legal frameworks, cultural policy, and how the latter is tied to institutional funding arrangements. Additionally, how museums track and respond to their OD contribution remains relatively poorly understood (Sanderhoff, 2013;

Terras, 2015; Schmidt, 2018). Through comparative case study, we address the need to investigate the interdependencies between OD and art museum users, and the interaction mechanisms of feedback within the digital information ecosystem where art museums operate. In doing so, we ask: *In forming their policy towards OD, how do art museums interact with and respond to the OD ecosystems they are part of, comprising internal and external components such as cultural policy, legal frameworks, user groups, and economic conditions and incentives?*

Contextualizing our inquiry, technical processes to adopt and advance OD are well documented, (Avila-Garzon 2020; De Boer et al. 2013), as are challenges faced. Gaps in international legal frameworks hinder simple open publication of heritage collections (Wallace and Euler, 2020). A lack of awareness of the benefits of enabling semantic connection of unstructured data available on the Internet (Avila-Garzon, 2020) has resulted in a lethargic adoption in spite of expanding cultural policy directives. Further complications emerge from uncertainties about terms such as OD, LOD, and the semantic web (Rasmussen Pennington and Cagnazzo, 2019), as well as numerous interpretations of “open” (Pomerantz and Peek, 2016). A commonly cited definition is that “[o]pen means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness)”. As such, OD is a technical method to enable data access, as well as an epistemic stance that acknowledges the value of data reuse.

We begin by briefly reviewing existing studies of museum and heritage institution OD adoption, with an emphasis on the suitability of an ecosystems approach for comparing the informational dynamics impacting OD policy in three mid-sized European art museums. Utilizing research from the more developed open government data field, we propose five ecosystem components for analysing the dynamics of three ecosystems which we define as local museum centric, yet also connected to a larger international ecosystem. Following

analysis and comparison of the three ecosystems, we discuss key challenges to the development of functioning and sustainable art museum OD ecosystems.

## **2. Literature**

To position our study within existing research, we searched three databases (Scopus, Web of Sciences, and Science Direct) and the archives of the Museums and the Web conference for qualitative studies of OD in museums. Existing research includes ‘single case studies’ of OD and LOD adoption (e.g. De Boer *et al.*, 2013) and the broader legal, ontological, and technical environment in which a museum’s OD decisions and policy are shaped (e.g., Szekely *et al.*, 2013). ‘Multiple case studies’ have examined how digital innovation evolves within selected museums (e.g., Dupuy, Juanals and Minel, 2015), and how political and social actors impact museum OD practices (e.g., Teneketzis, 2020). Other studies have examined a range of challenges associated with museum OD, including how to build and sustain OD networks (e.g., Baltussen *et al.*, 2014), museum and societal advantages and risks from publishing OD (e.g., Oomen, Baltussen and van Erp, 2012), institutional friction towards OD in the context of policy directives (e.g., Passel and Rigole, 2014), and the organizational challenge of moving from ‘technical skills’ to ‘digital literacy’ mindset in a museum (Parry *et al.*, 2018).

We find a lack of qualitative studies comparing how different museums formulate OD policy in the context of internal resources, policy and funding pressures, legal constraints and user needs. Closer in this regard have been studies of factors influencing ICT adoption within heritage institutions. Employing quantitative methods, these have used a relatively narrow set of theoretical framings, including: innovation diffusion theory (Estermann, 2016, 2018a; Borowiecki and Navarrete, 2017); stage models (Estermann, 2014, 2016); Lee and Kwak’s version of an e-government stage model (Estermann, 2014, 2016, 2018a); Berners-Lee’s 5-star-model (Estermann, 2018a); Moore’s five categories of innovation adoption behaviours (Gombault, Allal-Chérif and Décamps, 2016); Castañer and Campos’ macro (national level),

meso (sector level) and micro (organizational level) framework for analysing innovation (Borowiecki and Navarrete, 2017); and the ecosystem analytical framework (Estermann, 2020). Using variants of these models, studies have investigated factors impacting digitization of museum collections (Borowiecki and Navarrete, 2017), OD adoption in heritage institutions (Estermann, 2014, 2016, 2018a), types of ICT adoption behaviour within heritage institutions (Gombault, Allal-Chérif and Décamps, 2016; Gombault *et al.*, 2018), and interdependencies of key stakeholders for a viable LOD ecosystem for the performing arts (Estermann, 2020).

**Table I:** *Factors related to ICT and OD adoption in heritage institutions*

	<i>Level</i>	<i>Factor</i>	<i>Study</i>
<b>Effective prerequisites for adoption of OD in museums</b>	<b>Micro</b>	Adoption of social media use.	Estermann (2016, 2018)
		Digitization of collections.	Estermann (2016, 2018); Borowiecki & Navarrete (2017)
<b>Factors positively related to OD prerequisite (social media)</b>	<b>Micro</b>	Institutions with wider geographical reach.	Estermann (2016)
		Workforce comprising both paid staff and volunteers (compared to purely volunteer workforce).	Estermann (2016)
<b>Factors positively related to OD prerequisites (digitization)</b>	<b>Macro</b>	Countries with mid- or high-educational attainment.	Borowiecki & Navarrete (2017)
		Countries with greater wealth, population, and access to the Internet but lower education attainment tend to have a proportionally smaller digitisation budget and digitize less.	Borowiecki & Navarrete (2017)
	<b>Meso</b>	Institution type (museums compared to libraries).	Estermann (2016)
		Institution type (museums compared to archives and libraries).	Borowiecki & Navarrete (2017)
	<b>Micro</b>	Institutions holding born digital resources.	Estermann (2016)
		Institutions with policy strategy for digital activities.	Borowiecki & Navarrete (2017)
		Wealthier institutions (budget).	Borowiecki & Navarrete (2017)
		Smaller organizations (FTEs).	Borowiecki & Navarrete (2017)
		Institutions with specialized staff.	Borowiecki & Navarrete (2017)
		Creative (rather than historical and traditional) use of content.	Borowiecki & Navarrete (2017)
<b>Factors positively related to general ICT adoption</b>	<b>Meso</b>	Museum type (science museum compared to historic monuments and museums).	Gombault et al. (2018)
	<b>Micro</b>	Decision-making autonomy in recruitment, budget management and strategizing.	Gombault et al. (2018)
		The size of the heritage organization (large compared to small).	Gombault et al. (2018)
		The number of digitally competent staff.	Gombault et al. (2018)
		Degree of museum networking within local governments and organizations to create a destination.	Gombault et al. (2018)
<b>Factors positively related to adoption of OD in museums</b>	<b>Macro</b>	E-Participation Index.	Estermann (2016); Borowiecki & Navarrete (2017)
	<b>Meso</b>	Institution type (archives compared to museums and libraries).	Estermann (2016)

<b>Unrelated factors</b>	<b>Micro</b>	Existence of centrally managed metadata.	Estermann (2016)
	<b>Macro</b>	GDP.	Estermann (2016)
		Level of effective information and/or educational offered.	Estermann (2016)

A functioning museum OD ecosystem requires more than resolution of supply side issues. Estermann (2018b, para. 3) captures this sentiment: “Without complete and high-quality data, there are no cool apps. But without interesting apps, there are few incentives to provide data and to improve its quality”. Supply side orientated frameworks for studying technology adoption may also neglect the surrounding context of policy, legal complexities, and public sector values (Grönlund, 2010).

Simply delivering OD to the next step of the value chain does not ensure that the end-user benefits from it. While research on museum OD users and usage has developed in terms of identifying target user groups (e.g., Lemmens, 2020), prototype applications (e.g., Oomen, Baltussen and van Erp, 2012), aggregators collecting LOD (Stimler, Rawlinson and Lih, 2019), and, to a lesser extent, actual user groups (Navarrete and Villaespesa, 2019), there is little research reporting usage statistics, user experiences or their interface needs (Terras, 2015; Schmidt, 2018; Neely, Luther and Weinard, 2019).

Looking beyond supply-side concerns, OD projects can be understood as parts of ‘ecosystems’ (Pollock, 2011; Dawes, Vidiasova and Parkhimovich, 2016). Borrowing Nardi and Day’s (1999, p. 49) definition, an OD ecosystem is “a system of people, practices, values, and technologies in a particular local environment” responding to the needs and challenges of the OD concept. Ecosystems rely on boundaries defining where actor interactions and information flows occur (Zuiderwijk, Janssen and Davis, 2014), and may therefore be understood through a focal organization, a technology or platform, geographic boundaries, or types of information and value flows (Ritala and Almpantopoulou, 2017). Moreover, OD ecosystems can be analysed from multiple perspectives, including ecosystems of business,



innovation, information, and digitization (Zuiderwijk, Janssen and Davis, 2014).

The ecosystems metaphor is widely referenced in OD literature, with theoretical studies proposing different ecosystem components (see Lnenicka and Komarkova, 2019). The few attempts to map components of OD ecosystems into an empirical equivalent have occurred in relation to open government data (Dawes, Vidasova and Parkhimovich, 2016; Styrin, Luna-Reyes and Harrison, 2017; Kassen, 2018), and we are aware of none corresponding to open museum data. While components vary depending on the specific ecosystem, those used in studies of open government data are of potential relevance to museums OD ecosystems.

**Table II:** *Ecosystems components used in empirical studies on open government data*

<u><b>Ecosystem component</b></u>	<u><b>Description</b></u>	<u><b>Study</b></u>
<b>National and global trends</b>	National and global trends that influence OD program development in any particular government.	Dawes, Vidasova, & Parkhimovich (2016)
<b>Political centralization of policy</b>	Centralization/decentralization of OD policies	Kassen (2018)
<b>Government policy and practices</b>	Government laws, policies, and directives used to define OD policy and to conceptualize the processes by which the policy will be enacted.	Styrin, Luna-Reyes, & Harrison (2017) Dawes et al. (2016) Henman and Graham (2020)
<b>Hierarchical structure of data management</b>	Degree of autonomy and self-governance versus administrative and cost control	Kassen (2018)
<b>Process of OD implementation</b>	National, sub-national and local implementation versus unified national strategy of implementation	Kassen (2018)
<b>Data management and publication practices</b>	Mixture of implementation and operational requirements, resources, and activities to prepare and publish data for public use.	Styrin et al. (2017) Dawes et al. (2016)
<b>Stakeholder engagement with OD</b>	Interactions between government actors, private organizations and individuals that use data as application input or output	Styrin et al. (2017) Dawes et al. (2016)
<b>Feedback and communication mechanisms</b>	Mechanism for feedback, including opinion polls, ways to request new datasets or comment on existing ones, or invitations to participate in OD	Dawes et al. (2016)
<b>Perceived benefits</b>	Benefits to different stakeholders (organizations and individuals in the private sector, civil society, and the government itself) from data use and associated information products and services	Dawes et al. (2016)

Using an ecosystem perspective to explore the feedback-based relationship among key

components, we expect to see differences in OD perceptions, implementation and practices resulting from local cultural, policy, legal and organizational contexts (Styrin, Luna-Reyes and Harrison, 2017). The ecosystem framing invariably has limitations as an applied method. Empirical analysis of ecosystems might entail more complexity than the case study method can adequately handle, ecosystems analysis can lack methodical rigor (Oh *et al.*, 2016), and there might be arbitrariness in how ecosystems are defined and which components are analysed. As per Ritala & Almpantopoulou (2017), we recognize this limitation as plaguing multi-actor network studies, and note that there are nevertheless benefits to academic inquiry into OD ecosystems.

### **3. Methodological approach and cases**

We structure our research as a multiple case study based on three OD ecosystems centred around a mid-sized art museum. While we have attempted to maintain common attributes across the museums, an international study necessitates a degree of heterogeneity to give greater clarity to non-museum components within the corresponding ecosystem. Given the relative scarcity of qualitative studies of museum OD ecosystems, our study is framed as exploratory research that nevertheless aims to contribute to the development of theoretical propositions concerning *how* and *why* questions (Yin, 2009).

#### *3.1 Case selection and summary of profiles*

Case selection sought homogeneity defined partly by a funding requirement that a Norwegian museum be included. We set the additional criteria that part of the museum's collection is art-based, copyright over a significant proportion of the collection is in the public domain, the museum has published some of its collection as OD, and the museum is of sufficient scale that OD offerings could be significantly developed if prioritized. In Norway, Oslo's Munch Museum (hereafter "MM") was a suitable candidate.

To ensure a degree of comparability across cases, we refined case eligibility criteria from the characteristics of MM: i) mid-size visitation (250,000 – 1 million average annual visits) and ii) mid-size scale (80 – 150 full-time equivalents/FTEs). Collections provide an additional comparison point, as the museum holds ownership for most of the content and the issue of orphan works is less relevant for our three cases.<sup>1</sup> Limiting our study to Europe, with an aim of permitting cultural, policy, funding, and audience contextual differences, the Netherlands and Spain were selected, with Centraal Museum in Utrecht as our Dutch case and Museo Nacional Thyssen-Bornemisza in Madrid as our Spanish case (hereafter “CM” and “TBM” respectively).

**Table III.** *Overview of cases*

	<u>Munch Museum (MM)</u>	<u>Centraal Museum (CM, 2018)</u>	<u>Thyssen-Bornemisza Museum (TBM, 2018)</u>
<b>Type of collection</b>	Art, texts, artist personal belongings (modern)	Kaleidoscopic (ancient art, modern and contemporary art, applied arts, historic, and costumes)	Art (ancient to modern)
<b>Annual visits</b>	283,000 visits	389,000 visits	928,000 visits
<b>Annual budget</b>	€17.7 million	€14.5 million	€19,2 million
<b>Size of staff</b>	124 staff	97 permanent staff (+ 13 temporary, 86 external, 22 interns, and 100 volunteers)	141 staff
<b>Size of collection</b>	42,000 objects	60,000 objects (521 currently on view)	768 objects + 304 objects from private collections on loan (all currently on view)
<b>Share of collection online</b>	10,425 objects in website 3684 works in Europeana	59,196 objects in website 19,885 works in Europeana	768 objects in website 500 works in Europeana
<b>OD definition/view</b>	Making metadata and images available for both human exploration and reuse, and machine reading	Making metadata and/or images available for others to decide contextual reuse.	Primarily for data, to enable machine reading.
<b>OD practice</b>	Metadata and images (photographs as CC BY 4)	Only metadata, images fully in copyright	Only metadata, images fully in copyright
<b>Software used</b>	TMS	Adlib (Axiell)	Ad hoc system
<b>Date to start OD</b>	2011	2012	2014
<b>Main trigger to start working with OD</b>	Ending of 70-year copyright over Munch’s works in 2015.	Participation in a workshop Open Culture Data API.	Delivery to Europeana.

<b>Main staff responsible / staff involved</b>	CTO, Digital collections manager, Database administrator (unable to determine FTE)	Head of collections (1FTE) and occasional supporting volunteer	Head of Technology and Web Manager (2FTE)
<b>Current state of OD</b>	Digitizing remaining collection, developing APIs and documentation to encourage use.	Dormant due to lack of staff.	Exploring legal and economic dimensions.
<b>OD publication via museum directly</b>	eMunch website, APIs published via Github	Upon request	For machines only

*3.2 Data collection, validity and limitations*

The case studies are based on seven in-depth interviews with museum management staff across the three museums, and interviews with policy-related agencies in each country. All interviews took place between September 2019 and August 2020 and were semi-structured to ensure consistency while allowing a degree of adaptability. Subject to role relevance and availability, museum interviews were targeted at one or more of the digital manager, digital education, outreach manager, and museum director levels. Policy related agency interviews took place with representatives of Arts Council Norway, the Dutch Digital Heritage Network, and a Spanish representative of the Department of Heritage Collections of the Ministry of Culture and Sports. Additionally, we employed document analysis of government policy documents and policy research literature, as well as museum-generated documents providing descriptions, assessments, and procedures for OD involvement, including strategy documents, reports and grant applications.

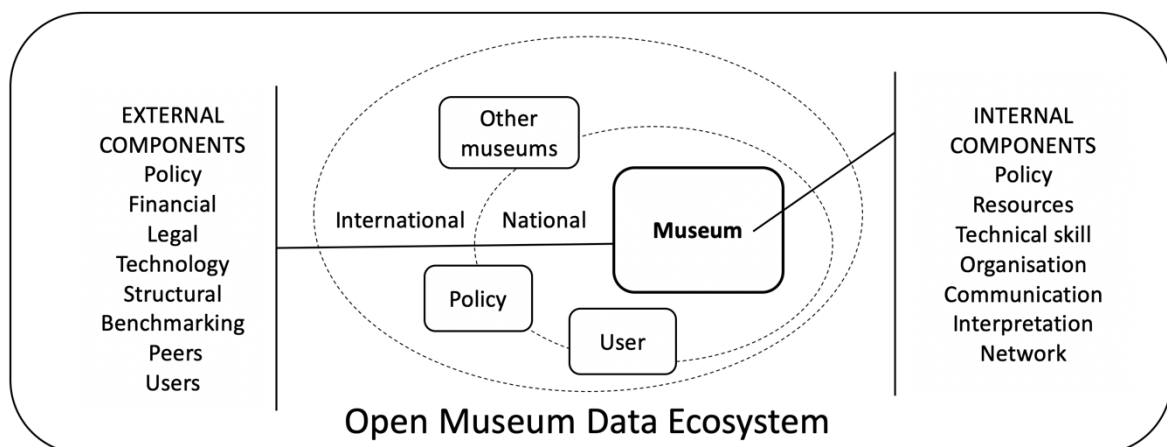
Generalizability of our findings is limited by the specifics of the cases, which we do not purport to be representative of the entire art museum sector, particularly given the relative heterogeneity of museum collections. Moreover, the particularities of art museums in the wider cultural heritage sector limits the degree to which findings can be generalized for the latter. Our cases are indicative of mid-size European art museum ecosystems, reflecting all the strategic differences that occur even within this narrower sub-category.

### 3.3 Data coding and analysis

Analysis proceeded by categorising case study data into a subset of the ecosystem components identified in previous studies (see Table 2). Simplifying this list to a set of five context-sensitive ecosystem components, we employed a mixed methods comparative approach to analyse each component within the three art museum-centric ecosystems.

**International and national influences** capture international and national conditions and trends directly or indirectly related to communication about open museum data, that subsequently impact interpretation of what OD means in the museum organization. **OD related policies and strategy** capture government directed factors linked to open museum data and includes relevant legislation, copyright laws and arrangements, cultural policy, and arrangements for public museum funding. **Data management and publication practices** reflect the implementation and operational requirements, resources, technical skills, and activities demanded of the museum and intermediaries to prepare and publish data for public use. **Benefits and costs** reflect a museum's perception of its own return on investment, and their perception of the broader set of net benefits that accrue to stakeholders through use of OD and its associated products and services. Finally, **Audiences and users** reflect how museums perceive their OD offerings and communicate them to their users.

**Figure 1.** Main actors in and components of the open museum data ecosystem



## 4. Ecosystem analysis and comparison

### *4.1 International and national influences*

All three cases are influenced by international and national developments in OD and LOD.

One MM informant notes, “the museums that tend to drive things internationally are the Tate, MOMA, and other large well-known museums.” All our cases acknowledge that publishing collections as OD is a benchmark reflecting a technological maturity consistent with a reputable museum. Two of our cases also noted that OD offerings may be constrained by institutional size and the reputation of the museum’s collection.

Especially influencing our cases’ perception of OD is Europeana, the EU financed international heritage portal with significant partnering force. Though each museum relates differently to their own national aggregator, all metadata is published as open (CC0 license) and each museum is able to choose their image licensing. Here, none of our cases align with the OD CC0 license. MM published its collection of Munch’s texts on Europeana via the LoCloud initiative in 2015 and claims CC BY license requiring attribution. TBM delivered its collection to Europeana in 2014 with a CC BY-NC-ND, preventing commercial and derivative works. CM first published collections through OD for the Europeana Fashion project (2012–2015) with copyright. Beyond voluntary initiatives, one TBM employee noted political pressure to join Europeana: “When the European Commission came, especially to talk with our director and insist that we went to Europeana, that was a huge push.” Due to the complexity induced by the number of licenses Europeana offers (currently 13), and the request that data be open to both private and commercial reuse, all three museums signalled varying degrees of frustration towards Europeana-imposed standards and licensing conditions.

Beyond Europeana, a global network of individuals and institutions developing standards to enable interoperability and reuse of information online has influenced the three museums. These include the World Wide Web Consortium (W3C), developing the Semantic

Web and a series of metadata models such as the Resource Description Framework (RDF). Getty's Art and Architecture Thesaurus (AAT) is leveraged by Europeana and impacts how partners deliver their data (Europeana Foundation, 2014). Other initiatives specific to the heritage sector include the Dublin Core Metadata Initiative (DCMI), the International Committee of Documentation of the International Council of Museums (CIDOC) and its Conceptual Reference Model (CIDOC CRM). Such networks influence museums' perception of OD directly by raising the technical knowledge of museum staff, and indirectly through sectoral communication channels and museum peers. Informants across the three museums mentioned other LODLAM community (see <https://lod-lam.net>) events oriented towards learning about current practices and future trends, including the Museums and the Web, the Museum Computer Network, the Sharing is Caring Conference, and the International Open Data Conference.

National initiatives contribute to OD cultural infrastructure by collecting and exchanging knowledge and experiences on open cultural data, stimulating new projects, running classes, and holding data re-use competitions. One example is Open Cultuur Data in the Netherlands, with a CM informant noting that the museum first published OD after she attended a 2012 Open Cultuur Data masterclass. Another is Arts Council Norway, which is part of a national collaborative forum for OD and is described by MM as having worked hard to "get the museums into OD".

All three cases are aware of national best practice. In Norway, MM considers itself an early national adopter of OD, noting their project to publish all of Munch's written correspondence, launched in 2011. The museum does not consider itself influenced by other Norwegian museums in their OD practices, yet finds the OD initiatives of the National Museum to be noteworthy.

In Spain, TBM is located next to the museums Prado and Reina Sofia, which all share

ad hoc collections management systems, while other Spanish state museums share the same system, Domus. The influence among these museums is notable, as they continuously learn from (and compete with) each other. While TBM was the first of the three to join Europeana, Prado was the first to link their collections to Wikipedia, while Reina Sofia has been kept offline due to its modern collection under copyright.

In the Netherlands, a large museum software group, the Adlib user group, holds regular presentations about LOD and is an important learning venue for museums. Another is the Amsterdam Museum, a mid-sized museum with recognized expertise and a forerunner position in the Netherlands. “[They were] the first I ever heard talk about open data”, a CM informant notes. Another recognized expert is the Rijksmuseum in Amsterdam, an institution large enough to have legal staff able to answer copyright questions from other museums.

#### *4.2 OD related policies and strategy*

All three museums are aware of the national adoption of international policies, with various levels of understanding of the national implementation of the Public Sector Information (PSI) Directive. The 2003 PSI Directive (Directive 2003/98/EC) seeks to harmonise the use of public sector information and stimulate an information and knowledge society. The directive defines re-use in article 2 as “the use by persons or legal entities [...] for commercial or non-commercial purposes other than the initial purpose within the public task for which the documents were produced” (European Union, 2003, p. 5). In 2013, The PSI Directive was amended to include museums, acknowledging their role as public entities, their dependence on licensing income, as well as their complex data formats. The directive addresses greater harmonisation, the possibility to charge for access to materials, and the consideration of all formats of content, including metadata, when complying with open standards.

The 2019 ‘Open Data Directive’ (Directive (EU) 2019/1024), replacing previous versions of the PSI Directive, states no obligation to permit re-use, except when required by



national law, but highlights the importance of making content available for re-use proactively, ensuring discoverability, interoperability, re-use and accessibility, by providing content and associated metadata dynamically through Application Programming Interfaces (APIs). Digital collections information is considered a specific high-value dataset which is to be published for download free of charge, also in machine readable form (Art. 14).

For our cases, national laws<sup>[2]</sup> add clarity to the European Directives, which have been implemented with minimal differences in all three countries. White papers and other policy-oriented initiatives play an important role in all three countries. In Norway, a white paper presenting primary priorities on ICT policies (Norwegian Ministry of Local Government and Modernisation, 2016) identifies the cultural sector as one where utilization of OD is particularly valuable. The government's strategy for open cultural data for 2017–2022 calls for a “culture of openness and transparency, wherein data, as a basic principle, is made openly available” (Norwegian Ministry of Culture, 2017, p. 4, our translation). Norwegian OD policy nevertheless follows a ‘hands-off’ approach: Museums choose what to publish as OD, standard publishing formats are not imposed, and museums are not singled out to take responsibility for knowledge or specific OD tasks. Norwegian policy makers note several challenges, including copyright concerns, outdated technological infrastructure and limited technical competency and resources (Norwegian Ministry of Culture, 2017). The concept of OD has yet to be markedly implemented in government agencies and public institutions, there is a lack of knowledge and statistics on the use of open cultural data, and in the heritage sector, notions of openness and accessibility remain largely tied to ‘traditional’ digital access to heritage content (Norwegian Ministry of Culture, 2017).

In the Netherlands, harmonisation and development in the use of standards has been envisioned as a bottom-up approach. In 2014, the Ministry of Culture funded Digital Network for Heritage (*Netwerk Digitaal Erfgoed*, or NDE), with five national heritage institutions

serving as nodes to develop joint solutions to advance visible, usable, and sustainable digital heritage. In 2018, the NDE was joined by the Netherlands Coalition for Digital Preservation (NCDD) and together they coordinate a national network made by expert representatives from each province organised by theme (visibility, usability, and sustainability) across sectors. Since 2019, the NDE organises digital heritage coaches who advance digital literacy. The NDE works with software providers of museum information management systems to ensure they facilitate the adoption of a Digital Heritage Reference Architecture (DERA). The NDE also works with local funding government bodies to link museum funding schemes to the adoption of an agreed upon architecture. As such, much of the architecture and general plan of NDE effectively embodies a top-down approach.

The digitization of heritage in the Netherlands is driven by an increasingly digital open government. The NL Digital 2020 Agenda identifies the impact of digitization, seeks to improve collaborations to provide government information as OD, and views data as a means to achieve the desired goals in all sectors of a vibrant society and economy.

In Spain, the Ministry of Culture and Sports aims to ensure democratic access to culture, viewing digitization and OD as tools to increase accessibility and visibility of cultural heritage, as well as a means to improve social well-being. Spanish OD policy is nevertheless limited by the costs associated with digitization and the creation of OD, the digital cultural gap, and the challenges of harmonizing with the rest of the European digital single market. The Ministry of Culture and Sport encourages museums to collaborate with Wikipedia to increase dissemination and reuse of collections.

#### *4.3 Data management and publication practices*

Internal policy on OD varies between the three museums, due to differing organizational structures, technical skills, and the OD understanding of responsible staff. OD is managed by the Chief Digital Officer at MM, the Information and Communication Technology

Department at TBM, and the head of Collections at CM.

While MM does not have a specific policy covering OD management and publication, the expiration of copyright over Munch's work in 2015 was a trigger for releasing part of the digital collection as OD. Initially lacking the in-house competencies to work with OD, one employee reflects, "It's been about learning by doing here". Typical of most OD projects to date, the 2015 collaboration with the National Archives of Norway to include parts of the collection in Europeana was short term, pausing once the external and internal resources expired. Generally, OD projects have been dependent on the interest, initiatives and availability of key staff. Frustrated by lack of continuity in OD projects, one informant says "it's very piecemeal and divided". Recognizing these weaknesses, MM, in 2019, appointed a new director for digitization and a dedicated database administrator responsible for building the APIs for digital collections to be accessed by various OD aggregators. This reflects a strategy to have greater in-house competence for digital collection dissemination, and to be able to query own and others' APIs as required. While staff indicate ambition to collaborate with other museums, it is currently considered unachievable due to variation in standards, limited OD from other museums, and a wish to first refine the museums' own data and competence.

CM considers providing OD collection access a form of publication service that mostly benefits external users. Although the collection was published online in 2010 (all in copyright), and the museum has participated in various hackathons and OD workshops, it is challenging to adapt internal processes to make the small staff put OD to use. The head of collections is responsible for loans, conservation, storage facilities and so on, making OD "a tiny, tiny part of what we do". Adding to the challenge, the business and artistic directors are perceived to be less knowledgeable of the potential benefits of LOD and have not allocated resources to advance the information side of the museum in accordance with national open

government policy. A programmer sporadically supports data structuring so that a portion of the collection is linkable to the national databases of the Netherlands Institute for Art History (RKD), including biographical information, image descriptions and other controlled vocabularies for Dutch collections.

For TBM, OD reuse is perceived primarily for curatorial staff to advance research. The museum has held workshops to educate curatorial staff on the benefits of an open and semantic data approach. The technical department has attended several international meetings on the topic and continue to learn about the technical requirements that enable a LOD strategy. At management level, future uncertainty and risk aversion prevent TBM from fully adopting an OD strategy, and all collections are published with copyright. To meet future financing needs, the museum seeks additional sources of income from corporate collaborations, for instance the reuse of collection images for products by Zara and Swatch. Fearing such collaborations will cease after releasing the API to access the entire collection, TBM would rather wait until new forms of corporate revenue emerge.

OD management and publication practices are impacted by legacy software and databases used by museums. Being part of the Oslo Municipality, MM would normally host its collection databases on the municipality's secure servers, where changes would have to be done by Oslo Municipality using arms-length pricing. The need for direct access to databases for ongoing adjustments has prompted MM to host its databases on Gallery Systems servers in New York. In using Gallery Systems' TMS management system rather than the Norwegian-developed solution, Primus, MM faces the disadvantage of being prevented from feeding data to the national museum collection database, DigitaltMuseum. However, TMS could potentially position MM into an international network of TMS users.

TBM is considering adopting new software, which would make it possible to publish an OD service on the museum's website. The museum wishes to provide a series of examples

on how to link their collections data to other datasets, such as Wikidata, to incentivize reuse of collections. The software used by CM has recently incorporated the use of URIs (uniform resource identifier) as automated persistent identifier for each collection object, which is expected to increase the use of LOD.

#### *4.4 Benefits and costs*

Each museum perceives the benefits of OD differently, with institutional notions of ‘benefits’ influencing the conception of returns based on perceived costs.

MM associates benefits with branding, enriching its collection, and building competency. Although operationalization is at an early stage, OD and LOD technologies are expected to bring labour savings in research and curatorial activities. Rather than accessing imagery through existing websites or working across multiple databases, researchers and curators could save time using API technology that merges datasets, as well as LOD. With less clarity, MM suggests that OD technologies have contributed to in-house technical competency, which may generate additional (but so far unidentified) internal benefits. Currently, there is little measurement of the external impact of the museum’s OD beyond the “very, very small numbers” tracked on the museum’s OD interface, eMunch. While traffic to eMunch from Europeana is tracked, the museum receives no collection traffic data from Europeana. Despite the lack of data on traffic and impact, informants also point to the democratic benefits from opening collections and, in the future, their administrative data.

For CM, benefits from expanding its OD offerings are largely unknown due to a lack of use of linked sources. Without measurability, the museum retains a speculative notion of external benefits: “People can come up with things we haven’t even thought about”. For example, CM envisions labour costs savings for external researchers. However, the cost to make this happen is significant and outside of CM’s possibilities, and their current website is perceived to serve most needs of international researchers.

TBM notes a lack of financial benefits but appreciates the information exchange from the LOD network and the increased visibility associated with partnering with innovative heritage projects. Although gains are not yet visible, the greatest beneficiary of adopting OD is envisioned to be internal research staff, including curatorial and conservation departments. The museum is happy to invest in developing high-quality collection-based applications and is surprised by the low usage, which is similar to the marginal traffic to their collections via Europeana and Google Art Project. Expected external benefits are mostly conceived as public access to reusable information, which could be used with other data sources to create new perspectives (e.g., on artworks). TBM has a broad perspective of OD, which includes both collection and institutional information, and is considering creating a dashboard with data about staff, visitors, and the museum's carbon footprint.

With regards to costs, more intensified OD work at MM have relied on external funding. OD projects are framed by an effective cost of the risk of technological obsolescence and changed funding priorities. For example, in 2019, Arts Council Norway announced that the aggregator for Norwegian cultural data, Norvegiana, will be taken down as it is no longer their role to fund and maintain the technical solution, transferring the OD data quality and publication costs to the heritage institutions. In the absence of OD standards, lack of trust concerning OD quality is causing duplication of data across museums, including MM. Despite the recent hiring of a dedicated database administrator, MM is not currently able to quantify the FTE cost of developing and maintaining OD initiatives. The museum also notes the educational cost of OD, both in spreading knowledge internally, and externally in developing documentation to encourage OD usage.

For TBM, it took less than 2 months to map 500 objects to the Europeana metadata model and publish them as OD in 2014, representing a cost of 1 senior FTE for approximately 200 hours. Because the relatively small collection is not linked or harvested through the

national aggregator, additional costs to the museum's initial investment may be associated with participating in the Europeana network, e.g. through meetings. The costs of further advancing OD are not necessarily identified as such, but are seen as general operating costs related to automating internal processes and the organizational information flow.

CM has insufficient staff to allocate a dedicated OD advocate. The head of department in charge has had occasional training in OD technologies, but work pressures leave little time for OD activities. One volunteer has previously worked with data mashing to show artist gender and a general overview of the collection, though this has not been made available for OD reuse. As the collection is not fully digitized, the cost of documenting and photographing objects must be resolved before the museum commits to new OD activities. The use of LOD to reduce costs (e.g. by reusing descriptions of artists or techniques) has not been explored.

#### *4.5 Audiences and users*

Regarding how our cases perceive their OD services and communicate them to their users, all three museums note a lack of communication mechanisms to identify and respond to intermediary and end-users, which reflects a one-way broadcasting approach to OD publication.

In line with internal differences in how OD is understood, and a lack of knowledge about OD users, the perception of real and potential users of OD differs within MM. Non-technical staff identify potential human users: researchers, non-professional visitors looking for an image, commercial users looking for high-resolution and commercially reusable images, and technical or intermediary users who repackage the data for other user groups. Technical staff offered a narrower view of OD users: technical users, and, in the case of LOD, machines. Beyond a general sense that the museum's OD offerings receive little use, MM staff acknowledges that little is known about potential users and their needs. Measurability, suggests one informant, will be achieved as the museum's OD processes and expertise

mature. Similarly, another informant states, “The APIs will of course have some tools for registering traffic and requests”. In the current absence of such technology, MM acknowledges that it “should probably meet with potential user groups and talk about what this can be used for”, while noting that such a meeting would be best organized by an external organization. While MM notes good lines of communication with the research community, one informant expressed interest in speaking with commercial users, due to a perceived distance to such users and their needs. MM has otherwise been in contact with an important potential user, Wikimedia Commons, about linking images to the Wiki system. Despite the lack of user knowledge, MM has begun documenting and publishing how their APIs are to be used. Rather than the technical challenge of using the APIs, a greater perceived challenge concerns generating awareness of data and documentation.

TBM notes two important misconceptions regarding OD audiences and users. First, that there is an insufficient distinction between OD and the end-product or service resulting from it. “Open data is only [considered] for its focus on the people, and now open data should be focused on the machines”. Second, the assumption that with ease of access anybody will use a museum collection, is problematic. According to TBM, use depends on personal curiosity, the desire to tell a story using a network of relevant data sources. TBM’s position thus aligns with the notion that only actual use defines the value of OD.

For CM, actual usage is a less critical concern. Wanting to provide OD is linked to the museum’s obligation to care for its physical and digital collection, and to ensure that information is available for people to use. However, the lack of clarity on who the user may be prevents the museum from going ahead with OD projects. CM wants to serve its constituents, and “no one ever asks about” OD. Still, informants envision using LOD to support documentation and disseminate information during traveling exhibitions, noting a case where CM wanted to link to the persistent identifier of an image of an object on loan



from a museum in Paris, which used an image from a museum in London. However, the museum did not (yet) use persistent identifiers. For rare objects and images, this would be valuable for lending institutions.

## **5. Discussion**

Now in a position to respond to our initial research question, we reflect on the five ecosystem components and their impact on the OD policies of mid-sized European art museums.

Relating our findings to existing empirical and theoretical knowledge, it is useful to reflect on ecosystem components as dynamic macro, meso and micro factors.

On a meso level, the observation that national and international benchmark museums provide only limited exchange for further development of the museum OD ecosystem, and that there is an absence of formalized processes among museums for sharing competencies, standards and tasks to reduce inefficiencies in OD publication, suggests that museum OD development broadly remains in a pilot phase (Estermann, 2020). Museums that identify with a circuit of internationally recognized museums appear more motivated to adopt OD practices. This is consistent with previous findings of a positive relationship between the size of a heritage organization and ICT adoption (Gombault *et al.*, 2018), and provides some support for OD adoption confirming to a stage model. It may also suggest greater scope reputational and other benefits among internationally oriented museums, and that the pioneering of few highly resourced museums encourages some degree of conservatism among other museums, who accept their non-frontrunner position and wait to see what works.

On a macro level, the coordinated approach of aggregators such as Europeana contributes to a harmonised method of creating and publicizing OD, which may strengthen the visible impact of the cultural heritage field as museum OD is joined with data from other heritage actors (Avila-Garzon, 2020). The impact of aggregators and networks is, however, limited by complexity of standards (e.g., Europeana), perceived lack of longevity (e.g.,

Norvegiana), insufficient data usage feedback to museums, and the voluntary nature of participation within the networks.

International and national OD related policies and strategies are a macro factor that interact with museum OD policy and practices. While direct political interventions at the museum level may be a driver of change, EU and national directives currently have limited impact in accelerating museum OD initiatives. Theoretically tying funding schemes to the adoption of OD architecture, our Dutch case points to little policy incentive to alter OD activities. Mirroring evidence that higher levels of external pressures are positively related to OD adoption (Wang and Lo, 2016), and that effective OD programs rely on clear responsibilities and limitations (Dawes, Vidasova and Parkhimovich, 2016), the current policy and strategy approach is currently insufficient to change the dynamics of museum OD practices. A more effective external pressure could occur through changes, at a national level, to the EU's Open Data Directive that would effectively force museums to alter their publication practices and conditions of reuse. In the absence of more incisive changes, OD policies remain an ineffectual dynamic in the art museum OD ecosystem.

On a micro level, data management and publication practices reflect previous research that finds a positive relationship between staff specialization/digital competence and ICT adoption and digitization level (Borowiecki and Navarrete, 2017; Gombault *et al.*, 2018). Staff background unsurprisingly plays an important role in how OD is understood and whether it is formalized in policy. Where OD is managed by someone with technical background, we observe the more sophisticated understanding of OD as a semantic technology (machines as user) whose value nevertheless depends on meeting the needs of human users. Lack of specific OD policy does not appear to restrict museums in early stages of OD adoption, where learning by doing has been the tradition. However, and in line with Janssen *et al.* (2012), the absence of policy or strategy for realizing benefits from OD suggests

lack of understanding or support at the director level, reflecting the internal challenge of conceptualizing and communicating OD. Lack of senior management support and understanding of OD can be indicative of, and contribute to, the broader museum challenge of moving from a mindset of 'technical skills' to a 'digital literacy' (Parry *et al.*, 2018) where museum staff have more varied digital competencies and confidence to explore the possibilities of OD.

Our interviews indicate the relevance and impact of legacy databases on how and where museums release data. Museums negotiate a compromise between cost, flexibility, immediate needs, and alignment with other national and international digital infrastructures that can be connected to funding. Evident in the case of MM, legacy databases and management systems can assist or limit access to OD aggregators, changing who ultimately benefits from museum collection data. Another, and thus far inadequately addressed, internal dynamic impacting OD practices is institutional risk aversion. Where resources permit, risk aversion and concerns over peer standards continue to encourage a 'go it alone' approach to creating and publishing OD. Particularly for museums charged with raising a larger share of own budget, risk aversion concerning loss of future revenues from commercial re-use of images may limit the conditions attached to open-data usage, something that may perversely impact the cultural value of that collection over time.

The perceived benefits and costs of OD impacts museum policy and practices at micro and meso levels. An overarching finding is our cases indicate surprisingly little knowledge of the benefits and costs of OD. Possibly reflective of the myth that opening data is alone sufficient to yield benefits (Janssen, Charalabidis and Zuiderwijk, 2012), we observe an association between perceptions of OD's intrinsic value and muted activity towards making the data 'usable'. When perceived to carry reputational benefits, OD is associated with externally focused API development and documentation, even where there is no clear

understanding of user needs. Where perceived to offer operational efficiencies, there is a more technical focus on OD. Knowledge of the costs of OD activities appears to be positively associated with the degree to which OD is formalized into museum policy, and whether OD activities have been internally financed.

At a meso/micro level, the museums' limited knowledge of external users and their needs is surprising, although not entirely unexpected given recent calls for more attention to users in both museum (Terras, 2015; Roued-Cunliffe, 2020) and government OD literature (Lassinantti, Ståhlbröst and Runardotter, 2019). Poor communications with actual and potential users reflect a low level of technical maturity that hinders museums from publishing collections information as APIs, a lack of sustainable business models that prevents identification of intermediary users and their needs, and an internal perception that museum data is simply not being used unless requested. A functioning OD ecosystem requires feedback mechanisms to the data provider (Zuiderwijk, Janssen and Davis, 2014), and so greater collaboration with crowdsourced Wikidata applications such as Sum of All Paintings might raise data usage and communication for specific user groups. However, potential users and their needs are much broader. User exchange with the museum is then a critical weakness in the development of the museum OD ecosystem.

## **6. Conclusion**

From the three main actors identified in the OD ecosystem, art museums, government and users, the first benefactor of OD is the museum tapping into the global collection of documented cultural heritage data, with descriptions of artists, techniques, genres, and all the content that makes up a common pool of heritage information. The general user, being the intermediate and final user of open content, is still often absent from the art museum's perspective.

Representing a critical aspect of museum OD's 'chicken or egg problem' (Estermann,

2018b), relatively few examples of successful content reuse prevents a larger allocation of resources towards OD. In this regard, the impact of Covid-19 on the development of online solutions to solve short-term logistics can be a welcomed spark to restructuring archaic practices and adopt new solutions to reduce costs. OD can be used to construct a cultural heritage global resource robust enough to fuel the cultural sector at local levels as well as the creative industries and greater economy. But, as our study points to, more robust information flows between ecosystem components, particularly user groups, remains a challenge.

Future research avenues are many. Smaller institutions without economies of scale, who are less likely to reap reputational benefits, often experience a poorer 'return on investment' from OD activities. Important, then, is how the sector may stimulate local participation in a global infrastructure, including data reuse and inter-institutional collaborations for commons arrangements. There is also a need to investigate the legal framework required to satisfy the needs of institutions across EU and EEA member states so that policy directives, which otherwise lack teeth, might be used to greater effect. Finally, there is a critical need to measure the actual reuse of heritage OD. As it stands, limited usage and lack of knowledge about user needs remain critical impediments to a well-functioning museum OD ecosystem.

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[Name withheld for anonymity] is employed by Arts Council Norway but contributes to this article solely as an independent researcher.

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<sup>1</sup> The exception is MM’s collection of photographs and texts taken or written by third parties, which has created some challenges for identifying copyright owners.

<sup>2</sup> See for instance *Spanish Law* (No 18/2015); *the Dutch Bulletin of Acts and Decrees of the Law of 24 June 2015* (Staatsblad 2015/271); and *Lov om endringar i offentleglova (gjennomføring av endringsdirektivet til vidarebruksdirektivet)* (LOV-2017-04-28-22).