

Handbook on the Digital Creative Economy

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Museums

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Museums started exploring the use of computers in the 1960s, and by the 1990s many museums were in the process of adopting an automated work form to manage collections. By the 2000s the Internet had brought new distribution channels, and digitization became harder to avoid. During the last decade, there has been a revision in the work process, where information becomes a key asset and where the relation between the museum and its public changes to favor participatory services.

Many of the issues concerning the museum work (acquisition, preservation, exhibition, research and communication) have been thoroughly studied by cultural economists, and their insights can be applied to the digital equivalent, for instance to identify the effective use of resources for an increase in access (offline or online). There are, however, characteristic differences in the production, distribution and consumption processes as a result of digitization. These have not always been discussed.

This chapter reviews the economic literature on museums to focus on the areas relevant to digitization, applying existing theory in areas where no literature example can be found. Issues of intellectual property rights (and copyright) as a form of regulation are outside the scope of this chapter. In cultural economics, museums can be studied from three main perspectives: the museum institution (the ‘firm’ with inputs and outputs), the consumer of museum goods and the role of the government in supporting production of museum goods.

THE MUSEUM INSTITUTION

Museums have not changed much in their characteristics with the adoption of digitization. They are still non-profit organizations with multiple and complex functions revolving around acquisition, preservation, research, exhibition and communication of collections. Economists have looked at museums since the 1960s (see Frey and Meier, 2006 for a list of publications

on the economics of museums). An important contribution to the application of cultural economics to museums can be found in the thematic edition of the *Journal of Cultural Economics* in 1998. In it, museums' inputs and outputs were identified, the differences and similarities with other cultural sectors were explained and a mention or two about the Internet was made. It was still a bit early to report on the changes brought by digitization in museums. In the following, the digital aspects of museum institutions and work will be highlighted.

Inputs and Outputs

The primary input specific to the museum can be divided into capital (collection, building, hardware and data banks) and labor (Hutter, 1998: 102). Digital input includes the technology (hardware and software), the information database and the trained staff available (including registrars, curators and IT specialists, but also the entire staff). Lack of knowledgeable staff is an important deterrent in adopting digital technology (NMV and DEN, 2008).

The expectation that IT would increase output and reduce labor costs (Hutter, 1998: 104; Frey and Meier, 2006: 1025) has proved to be only partly true. Labor related to digital activities represents over 90 percent of the costs of the digital budget (DEN, 2009: 36). Registering and documenting museum objects remain manual activities, unlike library content, which is automatically catalogued upon production. Copyright clearance is another labor-intensive activity for museums wishing to publish collections online. Empirical work is needed to measure the extent to which digitization of production in museums faces the so-called cost disease, according to which a relative productivity lag drives up costs even with technological advancements.

Technological advancement can support other activities, including quality of imaging (photography, scanning, MRIs and so on), speed of scanning and processing text (with optical character recognition – OCR), cross-referencing (linking objects to themes) and increasing findability and distribution of content (onsite, online). The level of access and use of content is closely related to the degree of object registration and documentation (Zhang and Kamps, 2010). In other words, digital input strongly defines the use of output.

Output, according to Hutter (1998: 100), can be divided into (1) collecting, preserving and documenting; (2) showing (or exhibiting and communicating); and (3) selling. Output particularly related to digital technologies includes the website, digital publications (online and on CD-Roms) and virtual exhibitions (Hutter, 1998). Digital technologies have been applied to create new products and services as well as to devise new distribution channels (Bakhshi and Throsby, 2011: 1). Museums have experimented with alternative output forms,

including open data sets for reuse (a machine readable version of their collections database), software applications (digital publications for smart phones and tablets), and publishing content on other websites (including portals like Europeana and social media sites like Wikipedia or Flickr). Online publication has been limited by issues of copyright leading to what has been called the black hole of the twentieth century (CEU, 2012: 3).

Interestingly, exhibiting collections in digital form requires that all other activities have taken place first: acquisition, conservation, research, documentation and interpretation (O'Hagan, 1998: 205). Selling, of course, follows display, as in the case of licensing reproduction rights for publishing purposes. Digitization of collections is not only a technology related activity, or IT cost (Stein, 2012). Publishing collections online is a type of exhibition, and as such it requires all the above-mentioned activities to take place before the actual digitization can be completed (ideally including the image, an explanation, and a list of resources). Digitization, and publishing content on the web, represents high fixed costs.

Most of the time, access by one person or many to the digitized content represents little additional cost (close to zero marginal cost). However, sometimes the high online traffic may require additional costs to improve content delivery. Such was the case for Europeana, the European Digital Library, which required additional servers after receiving 10 million hits per hour shortly after being launched, 'crashing' the site (*BBC News*, 2008).

Digitization has represented a solution to the problem of exhibiting the museums' largest capital: the collection. Not all objects in the collection can be physically exhibited; estimates of displayed objects range between 4 and 10 percent (Frey, 1994: 50; Voorthuijsen, 2009), making it a recurring source of inefficiency for economists (Frey, 1994: 50; Heilbrun and Gray, 2001: 200). Empirical research is needed to calculate digitization costs in relation to the increased visibility of objects against the opportunity cost of collections not being shown.

The value of museums is generally linked to the collection and building as well as to the services provided by these assets (Throsby, 2001: 35). Regarding digitization, the greatest asset of the museum derives from its information system: in the information contained in the collected objects, the various institutional documents (the museum's archive) and the information held individually by museum staff (Trant, 2008; Zorich, 2008).

Versioning

One important benefit of digital technology is that it has facilitated versioning of output, generally associated with information goods as proposed by Shapiro and Varian (1999).

Versioning access modes to collections online, for instance, allow heritage institutions to implement price differentiation strategies. Table 29.1 shows product dimensions resulting from versioning heritage information.

Table 1 here

Versioning can take many forms. Museums can prepare digital materials related to an exhibition and offer peek previews, releasing the content selectively at different times, delaying time of publication. Content can be offered from a website and allow users to make a ‘my museum’ site, in a personalized user interface. Digitized content can be made accessible onsite for free but requires a charge to be accessed from the convenience of home or when delivered faster than normal (the so-called ‘rush’ fee).

When a digital high-resolution standard image has been produced, the museum can choose to make lower-resolution, black and white or cropped versions for distribution and sale at a different price. Higher-resolution files would be slower to download and make the system slower, though quick access can be achieved through partial download.

Features of online services can include delivering the content to be viewed in handheld devices (over the web or as a software application), with a language selection, and with a possibility to participate. Increasingly, services allow users to add content in the form of comments or images, or to take part in various activities (e.g. selection of works to be included in a future exhibit). Many options are possible for the permitted use of the accessible content. Users can be allowed to store content on the museum website, copy the images, download to print, share to social media sites, search the content, browse the themes, rate the quality (or popularity), purchase a copy (including a 3D print)[2] or reuse the content, for instance to program an software application.[3]

Many early image banks and collections online were accessible to paying members. A common practice is to publish only part of the collection online to the general public for free and to publish a more comprehensive version with work tools (such as specialized vocabulary) for professionals, often with the use of a password. Sensitive information regarding insurance, costs and security is generally accessible to selected staff. Viewers of collections online may receive support by a virtual information staff or through services like ‘Ask a curator’.[4] With video collections, a clip can be made accessible online, and only after request can the entire video be seen. Copyright plays an important role in making collections available or not (Landes, 2003). Institutions may choose to publish a thumbnail but no large image of copyrighted materials or charge the interested viewer for the copyright clearance.

Digital technology has changed consumption patterns, forcing museums to adapt to the new information market. Museums are exploring the application of new business models that fit within the new forms of consumption.

Creating content that can be delivered to mobile devices onsite and offsite (including software applications) is favored when delivered for free. Actually, ‘only blockbuster exhibitions have generated significant revenues for the museum and its tour providers’ (Burnette et al., 2011: 6).

Allocation of Resources

Museums can serve different information needs for which the best allocation of resources to deliver an output is closely linked to the institutional goals. Institutions can choose to digitize the collection in great detail, but limited resources (including time) may allow covering only a small portion of the collection. On the other hand, museums can engage in mass digitization projects, covering a larger portion of the collection yet with little information about each object.

In the Netherlands, two cases can best serve to exemplify these different approaches. The Amsterdam City Archive has calculated the cost related to storage of high-resolution images from large quantities of scanned archival material and concluded it was prohibitively expensive to deliver best practice image quality. Its mass digitization program (10 000 scans per week) has opted for a pragmatic approach scanning documents ensuring legibility at a basic level of imaging quality (Holtman, 2006). The opposite is true for the Amsterdam Rijksmuseum’s Print Cabinet Online project. The imaging and contextual information per object is to be of the highest quality, resulting in an output of only 25 000 digitized prints per year (Navarrete, forthcoming). Digitization remains an expensive activity. Identifying costs based on different types of output, while ensuring efficiency, remains a practical concern.

The discussion regarding the most effective allocation of resources is not new. Museums have struggled to balance the various core activities of acquisition, conservation, research and access, now expanded to digitization. The European Commission has recently published an overview of the current situation of digital heritage collections in 1951 institutions (including museums): 864 museums from 29 countries reported having close to 23 percent of their collections digitized; about 29 percent measure the access and use of the digital materials, and they allocate about 4.5 percent of their staff towards digital activities (Stroeker and Vogels, 2012), giving the closest indication of a digitization budget.[5] The low allocation of staff, and of resources, does not seem in accordance with the labor-intensive

nature of the digitization process, involving contextualization of information and copyright clearance. The difficulty in gathering data about digitization activities (production, costs and access) may perhaps be the reason why little economic research has been done in this area.

Research on adopting digital technology, who adopts first and why (Johnson and Thomas, 1998: 81), continues to provide room for research. Bakhshi and Throsby (2011) linked innovation to technology. Digitization is, most of all, a tool to support work processes (such as information management and communication with the public). Research and development on the application of digital technologies for the heritage sector is still rare.

DIGITAL HERITAGE CONSUMPTION

According to Bakhshi and Throsby (2011: 4), digitization serves as an innovation strategy to reach audiences by publishing collections online, setting up interactive profiles in social networks and allowing consumers to participate in content creation. This would allow museums to reach a larger share of the population (broadening the audience), to attract new consumers (diversifying the audience) and to intensify the engagement of audiences through interactivity (deepening the audience) (Bakhshi and Throsby, 2011: 4).

Digital content is also being consumed onsite. Museums can transfer their audio tour content to a digital base platform to give access to additional information about the objects being exhibited. Yet few consumers are 'mobile'. The San Francisco Museum of Modern Art reported only 12 percent of their visitors used the mobile phone tour (Burnette et al., 2011).

The number of visitors online is usually larger than onsite. An example is the Rijksmuseum, Amsterdam reporting just under 9 million visitors in 2010 (when only the Philips wing was open during remodeling), 1.1 million unique visits to the website and nearly 7 million search actions on the library research website (Rijksmuseum, 2010).

Digitization is believed to have resulted in an increased access to museum collections, representing a wider market (Johnson and Thomas, 1998: 80). As the cost of imaging decreased, museums enriched their information systems by adding visual representations to the object descriptions (Loebbecke and Thaller, 2011: 359). The distribution of digitized content, however, is still rare. For most museums, the main purpose of their websites is to stimulate *onsite* visits. In the Netherlands, only 31 percent of museums reported publishing part of their collections information online (DEN, 2009: 25), while 99 percent of museums reported having 'at least one website' (NMV and DEN, 2008).

The low level of publication of collections compared to the high online presence of the museum may be explained by the fear of cannibalization, or losing onsite visitors if

collections were to be made available online. However, the opposite seems to be true: the online visit complements the onsite visit (D. Peacock, 2002; Marty, 2008; Peereboom et al., 2010; Bakhski and Throsby, 2011: 10). Taking again the case of the Netherlands, only four museums had a website in 1998, growing to 81 percent by 2002 and again to 99 percent by 2007 (NMV and DEN, 2008). As the digital medium is slowly adopted and understood, it is to be expected that collection publication will take time to catch on.

Another argument against the publication of collections online has to do with the loss of the special sensation of experiencing objects onsite compared to viewing a reproduction online. The experience of copies of paintings and prints throughout history shows that valuation of reproductions has changed in time (for example, we now value engravings, which used to be seen as reproductions, as originals). One important element is that reproductions result in an increased access to images, making collections better known (Benhamou, 2006: 280). Clearly, digitization of museum collections is about the distribution of object information and not of the objects themselves. For digital art, being ‘born digital’ and by nature multiple (it can be seen at the same time in two or more different locations), issues of originality or copying are irrelevant.

For some, cultural information systems available online are seen as add-ons to the museum institution, while for others they are seen as a replacement of the onsite visit (Loebbecke and Thaller, 2011). But what exactly is the perception of the consumer? In the Netherlands, the number of visits to museums was much higher than the visits to museum websites in 2006, with 38 percent and 15 percent of the surveyed population respectively (at least one visit in the last year) (Wubs and Huysmans, 2006). A follow-up survey may deliver a different result.

Criteria for Selection and Consumption

Heritage consumption is known to return individual benefits (pleasure of viewing the pieces and impressing others by having seen them or having purchased a piece) as well as providing investment opportunities for the future (A. Peacock, 1997: 397). Consumption of digital heritage has other characteristics. It includes a selection process of a fundamentally different nature. Museums are used to selecting the content that is available to the consumer through the museum visit. The choice of a museum visit may follow criteria based on proximity, current exhibition or holiday destination. Online, it is the consumer who selects the content to be viewed and used from the available information space. The consumer also selects the distribution channel (such as a museum website, a search engine or a ‘virtual’ collection such

as the Google Art Project) to best fit his or her needs (Mackenzie Owen, 2007). It is about ‘the right information, in the right amount, and in the right package . . . provided at the right time’ (Yakel, 2000: 28).

Navarrete (2013) has proposed that digital cultural consumption follows a new set of principles shifting from cultural and economic values to information values. Consumers select content based on reliability, validity, completeness, actuality, verifiability, correctness, integrity, relevance and access. These criteria for selection are closer to information use than to cultural consumption (see Shapiro and Varian, 1999 for an overview of the economics of information).

Content on the Internet is expected to be free of charge (Farchy, 2003) and to suit the users’ needs. These needs are dependent on the consumer’s personal characteristics (age, gender, interests, needs), social role and general context (availability and knowledge of technology) (Boekhorst et al., 2005: 66–7). The consumer’s community context has been identified to play an important role in the consumer’s behavior on the Internet (Hutter, 2003). The Internet has only magnified the frame of reference to select consumption, a phenomenon that has been previously observed with radio, film, television and recorded music (Frey, 1998: 116).

The general consumer more often selects digital heritage material from what Frey (1998) has described as ‘superstar’ museums. These institutions hold the ‘world famous painters and world famous paintings’ (Frey, 1998: 114). That is partially because selection for distribution favors famous works. Google first approached 17 superstar museums to be part of the Google Art Project, including the Van Gogh Museum and the Rijksmuseum in Amsterdam, the Museum of Modern Art and the Metropolitan Museum of Art in New York, the Museo Reina Sofia and Museo Thyssen-Bornemisza in Madrid, and Tate Britain and the National Gallery in London. The project has expanded to showcase 151 museums from 40 countries. [6]

Onsite, visitors are willing to pay a higher entrance fee to see superstar museums and temporary exhibitions in order to see the world-famous painters and paintings (Frey and Meier, 2006: 1036–40). Online, consumers are willing to substitute quality for free access, high resolution for speed, and branding for convenience. It no longer matters where the content comes from as long as it satisfies the information need. Many users are more interested in finding information (images, background documentation) than in visiting a specific museum online. This is in conflict with the tendency of museums to use the Internet as a promotional device for themselves as institutions.

Users' Data

Digital content from museums can be found at the museum websites, but also in the Google Art Project, Wikipedia, image banks, iTunes and Europeana, as well as in a number of video games, blogs and software applications. Little empirical work is found on the economic use and reuse of digital heritage materials because of the complexity in forms and channels for distribution. Research has been conducted on the information needs of the first users, the cultural heritage experts or museum staff, revealing that systems for information management are too simple. Users must combine information from several sources (e.g. the information about the object and its image from two different databases) and use relatively simple tools made for fact finding to do their research (Amin et al., 2008). Systems are not meeting the needs of the museum staff. It is therefore no surprise that experts (curators) have been reluctant to adopt the digital medium.

Similarly, users of the Metropolitan Museum of Art website 'want to search across data, on multiple dimensions, and find other artworks that interest them' (Rainbow et al., 2012: 1). Consumers expect relevant results to their search actions as much as experts do. However, this is not easy to achieve, since technical and procedural solutions generally require a change in organizational practice (Camarero et al., 2011: 253), often with financial implications. Observing the behavior of the general user has revealed that individuals benefit from the Internet's ease of searching for digital cultural heritage (accessible overall and any time) (Wubs and Huysmans, 2006). Searching usually begins from a keyword search using a search engine (Nordbotten, 2000), and selected content includes context (for example, image and explanation) (Zhang and Kamps, 2010). This means that institutions benefit from following the findability best practice to ensure their content is found, from positioning it also outside of their website (say on Wikipedia) and from presenting images linked to text (instead of a list of images with little context information). Empirical research is needed to measure the level of investment in online publication in relation to the actual use. Data from past technologies used (such as microfilm, photography, slides and videos) may serve for useful contrast. Demographic information of online users specific to museums would be beneficial. Visitors onsite are generally valued for the income they may represent (through ticket sales, shop, restaurant or parking fees). Visitors online are content users who require new measuring and valuation methods.

Digital technology allows the automatic documentation of user behavior, for example through web logs. This data holds quite interesting and mostly not exploited information

about digital cultural heritage users. Data includes the number of people visiting a website, the number of times a file was downloaded, the frequency of mentions in tweets, or the type of question words used in the search engine. D. Peacock (2002) discusses the potential of log files to produce quantitative data, and Voorbij (2009) analyses the current web analytics methods. Museums use web data for simple indicators, yet complex efficiency indicators could easily be devised, such as following the growth of access after digitization (frequency of access to a work before and after digitization). Twenty-nine percent of European museums reported gathering some form of consumers' data regarding use of digital content (Stroeker and Vogels, 2011), suggesting data may become increasingly available to better understand users' behavior. However, the use of performance indicators based on users' digital data is yet to be institutionalized in museums.

Production as a Service

Digitization has opened up the production process to include the consumer becoming a 'prosumer'. In a way this is not new. Johnson and Thomas (1998: 78) wrote about volunteers being a group who 'receive utility from the production process itself: they are both consumers and producers'. Digitally, consumers have an active stand and expect to participate as part of the museum experience.

Participation has many forms and can include sharing (participating in distribution), ranking (participating in ordering), commenting (supporting contextualization), correcting (improving the quality of information), adding new information (including text, images or video to expand the digital collection), reworking the data (for example, programming an app) and financing (known as 'crowdfunding'). Social media has served as a platform to satisfy participation without having to change much inside the institution. Contributing content, however, has raised questions of authority. If a museum publishes a catalogue that includes information provided by the public, who owns the content, who is responsible for it and who can profit from it?

Many art history students support data entry during their museum internships. Yet opening up public participation online has not been fully accepted. Selected museums are seeking presentation solutions for the two types of data (the authorized and the public one). Options include reviewing the consumers' data before merging it with the rest, or presenting multiple sources of information within the museum website (including text by curators, the public, Wikipedia and the like).

A number of Dutch museums are ‘freeing’ their data (images and metadata) to allow the public to rework collection information into new products. The Amsterdam Museum and the Rijksmuseum, Amsterdam are two examples of Dutch museums offering open data as a service. Users have visualized collections in a timeline and have applied face recognition software to all available images, to name a few examples. [7]

THE ROLE OF THE GOVERNMENT

The government has always played a key role in supporting adoption of new technologies (for a historical account of the role of the government in media adoption see Crowley and Heyer, 2003 and Briggs and Burke, 2009). Adoption of digital means has been no exception. Governments have supported digitization efforts through subsidies and through regulation. One study in Italy found that adoption of laser technology for the restoration of heritage depends on government intervention. While benefits were well known and the technology had been established, restoration firms presented a ‘significant resistance to adopting new technologies’ unless the State provided the explicit request or the funds for the use of laser technology (Verbano et al., 2008: 7).

In the Netherlands, the government first supported the use of computers in museums by making mainframe computers available for data processing in the 1960s and 1970s. Subsidies were given to selected projects throughout the years, but it was not until the 1990s that structural funds were earmarked, part of the e-government plan, for R&D and for advancing online services (Navarrete, forthcoming). The government also supported the establishment of a basic standard for object valuation, which was adopted nationwide in the 1990s through a comprehensive subsidy plan to inventory collections. From the mid-2000s, digitization projects were funded with increasingly strict guidelines to augment the use of standards and best practice, including earmarking funds for digital activities (Navarrete, forthcoming). Recently, the Dutch government has been supporting the commercialization of digital heritage content by supporting collaboration between museums and the private sector to develop new market products (Navarrete, forthcoming). This appears to be an international trend (Bakhshi and Throsby, 2011: 2).

Reasons for Supporting Digitization of Museum Collections

The government has three reasons for supporting digital activities in museums: efficiency, capitalization on past investment, and the welfare of present and future generations (public value). First, supporting the adoption of digital technology and the use of standards can assist

productivity improvement. Data management using paper cards limits the use of information, not to mention that it represents redundant work and has a higher chance of errors.

Harmonizing standard use in the work field assists the gathering of data to inform decision-making also at government level.

Dutch museums are what Schuster (1998) calls hybrid institutions. They are (for the most part) private independent organizations that care for collections (partly) owned by the government, they are housed in buildings (generally) owned by the state and they receive structural funding from the national, regional or local government (OCW, 2006). Digitization of objects has been (mostly) financed by the government. That makes digitized collections a type of government data. The Dutch government has an open data policy, meaning that government data should be freely available to the public. However, the heritage collections are yet to be considered (Donner, 2011).

Having a digitized collection paid for by the government, of objects that are property of the state, cared for by the museum, and in need of sustainable management has raised issues of long-term financial responsibility. The Dutch National Library has taken responsibility for storing and ensuring long term access to digitized collections paid for by government grants (i.e. part of the Memory of the Netherlands) (Navarrete, forthcoming).

A second reason for supporting digital activities has to do with the preservation of past investments and their future use. In the Netherlands, the largest government subsidies have been given for digitization aimed at the preservation of collections, first of all museum collections (the so-called Delta Plan for the Preservation of Collections running from 1990 until 1995), then for paper collections (under the Metamorfoze project started in 1997) and recently for audiovisual materials (the Images for the Future project planned from 2009 until 2013) (Navarrete, forthcoming), this last project having a huge budget of €154 million for seven years (TNO, 2010).

Digitized heritage content represents the repositioning of a past investment involving the acquisition, preservation and research of the objects. Allowing use and reuse of the digitized materials is seen by the Dutch government as key to stimulating innovation and production (Donner, 2011). Recent Dutch R&D funding schemes involve collaboration between heritage institutions and the private sector to bring new heritage products and services to the market (Navarrete, 2013).

Another reason to fund digitization relates to the safeguarding of access to the national cultural heritage by present and future generations (Camarero et al., 2011). Museum collections have been digitized to increase access to content and to preserve the original

object, so that future generations will have access to it. This is because cultural heritage is a merit good, because it has public good characteristics and because of the externalities brought by production and consumption (A. Peacock, 1997).

Digital preservation has also been on the government's agenda. The Dutch Department of Internal Affairs has been part of the Netherlands Coalition for Digital Sustainability in charge of developing an infrastructure to ensure sustainable access to content. [8] Preserving museum content is part of the Coalition's strategy.

Similarly, Europeana, the European Digital Library, was formed to increase access to European heritage materials. It has further adopted an open data policy, making 20 million objects (images and metadata) available for free reuse (with a creative commons public domain license). [9]

CONCLUSIONS

Economic research of museums has focused on descriptive applications of theory and on development of theoretic models for traditional activities. Digital activities have gained recent attention as to their role in innovation. Research that takes advantage of large digital data sets (such as web statistics) and that considers the museum as part of an information market (not only cultural or leisure) is on the future agenda.

Consumption onsite has been greatly analyzed. New forms of use and reuse have emerged. A better understanding of access and new forms to measure use are still an open field. Public funding of museums has had a great impact on the adoption of computers and in museums' digital practice. Curiously, funding for building a digital infrastructure (digitization of collections) remains limited, if existent at all.

There is still much room for research on the economics of digitization and museums. Future analysis would benefit from an interdisciplinary approach combining economic theory with information science.

NOTES

1. The publication resulted from a selection of papers presented at the Economics of Museums Conference held at Durham University in March 1998 (Johnson and Thomas, 1998).

2. The San Francisco Asian Art Museum and the New York Metropolitan Museum of Art are exploring the use of 3D technology to increase access to collections (<http://www.wired.com/design/2012/10/scanathon/>).
3. An example can be found in the Rijksmuseum, Amsterdam API (application programming interface) offered on their website for people to develop application software (see <http://www.rijksmuseum.nl/en/api?lang=en>).
4. The ‘Ask a curator day’ involves asking questions via Twitter, and the ‘Ask a curator’ website showcases curators answering questions. In 2010, 340 museums participated, and in 2012 it grew to more than 600. For an initial tweet analysis from 2012, see <http://blog.lamagnetica.com/2012/09/27/el-askacurator-day-en-numeros-y-valoraciones/>.
5. Data was gathered as part of the ENUMERATE project (2011–13); for information about the project see <http://www.enumerate.eu>.
6. http://en.wikipedia.org/wiki/Google_Art_Project.
7. <http://www.rijksmuseum.nl/en/api?lang=en>.
8. <http://www.ncdd.nl>.
9. <http://pro.europeana.eu/web/guest/news>.

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FURTHER READING

The basics of information economy can be found in Shapiro and Varian (1999). Crowley and Heyer (2003) and Briggs and Burke (2009) present a thorough history of issues related to the adoption of new technologies, including changes in the production, distribution and consumption of information goods. Navarrete (forthcoming) presents a detailed account of the digitization history of Dutch museums, including a chapter on government policy and financing. Navarrete (2013) gives an account of the supply and demand of digital heritage information. Beunen and Schiphof (2006) wrote a legal guide for online publication of museum content (in Dutch), including the basics of copyright. The *WIPO Guide on Managing Intellectual Property for Museums* is available at http://www.wipo.int/copyright/en/museums_ip/guide.html. The Museums and the Web international conference is a good reference for the application of digital technology in museum work.