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# Musei e mostre tra le due guerre

a cura di Silvia Cecchini e Patrizia Dragoni

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Altri contributi

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Saggi

# Digitization of Cultural Heritage and Business Model Innovation: The Case of the Uffizi Gallery in Florence

Luciana Lazzeretti\*  
Andrea Sartori\*\*

## *Abstract*

Recently, digitization has attracted increasing interest not only in museology and computer science, but also in economics and managerial literature. Scholars have tried to analyse how technological innovation is reshaping the role and mission of museums as producers and distributors of cultural content and investigate the new business model that emerges. The present work aims to investigate the adoption of ICT and innovation processes in museums, and their interaction dynamics between curators and technology developers.

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We analyse an Italian successful museum case study, the Uffizi Gallery in Florence, where digitization has been developed through a long-term partnership among the local University, a creative ICT enterprise and other technical partners. Data collection integrates some semi-structured interviews with information from websites, documents, publications, and the museum's institutional communication. The main results show that this case can be defined as a Virtual Value Chain Model according to a curatorial approach at European level.

Recentemente, la digitalizzazione ha attratto un interesse crescente non solo nelle discipline museologiche e informatiche, ma anche nella letteratura economica e manageriale. Gli studiosi hanno provato ad analizzare quanto l'innovazione tecnologica stia ridisegnando il ruolo e la mission dei musei come produttori e distributori di contenuti culturali, analizzando nel contempo i nuovi modelli imprenditoriali che emergono. Questo contributo intende investigare l'adozione delle tecnologie dell'informazione e di nuovi processi nei musei, e le dinamiche di interazione tra curatori e sviluppatori di tecnologie. Si analizza un caso di successo italiano, la galleria degli Uffizi di Firenze, dove la digitalizzazione è stata sviluppata nell'ambito di una lunga collaborazione con la locale Università, un'impresa creativa e altri partner tecnici. La raccolta di dati integra le interviste semi-strutturate con le informazioni dai siti web, documenti, pubblicazioni e la comunicazione istituzionale del museo. I principali risultati mostrano come questo caso possa essere definito come un modello di catena virtuale del valore secondo un approccio curatoriale a livello europeo.

### 1. *Digitization and Business Models in Cultural Settings*

The present work focuses on the digitization of tangible cultural heritage, defined as the conversion into digital format of the cultural artifacts preserved in museums.

The digitization of cultural heritage relies on the growing quality of technical equipment, as well as on the fast-increasing processing and memory capacities of computers to the purpose of acquiring, storing, archiving and distributing technically accurate reproductions of cultural artefacts and sites<sup>1</sup>.

Recently, digitization has attracted increasing interest not only in museology and computer science, but also in economics and managerial literature<sup>2</sup>. Scholars have tried to analyse how technological innovation is reshaping the role and mission of museums as producers and distributors of cultural content and investigate the new business model that emerges. In particular, they investigated how the transition to digitization and the Internet are affecting access to and use of digital collections and which are the current challenges and opportunities in this regard<sup>3</sup>.

<sup>1</sup> Muller 2002; Cameron 2003.

<sup>2</sup> Minghetti *et al.* 2001; Vom Lehn, Heath 2005.

<sup>3</sup> Navarrete 2013.

Such interest is increasing also due to the contribution to innovation and local development of creative and cultural industries and organizations after the financial crisis<sup>4</sup>. These innovations thrive under the new paradigm of “open innovation”, which has opened a wide debate on business models and eco-systems in cultural settings<sup>5</sup>; however, there is still a lack of established conceptual frameworks and empirical inquiries<sup>6</sup>.

Some studies of high-technology sectors applied to cultural goods try and investigate how Business Models (BM) change over time by examining the characteristics of firms<sup>7</sup>. The challenge would be to create a set of items<sup>8</sup> that define quantitatively the BM components and analyse their time evolution. In several cases, these situations take the form of a cross-fertilization, taking place with the application to cultural goods of technologies previously applied in other fields, thus according to an open innovation paradigm<sup>9</sup>. Although there is much interest in the application of high technologies to cultural settings, no formal definition of this experience has been provided yet<sup>10</sup>.

De Laurentis<sup>11</sup> illustrates a fundamental change of cultural industries in Wales, a transformation relating to the dynamics of knowledge exploration and exploitation within the local and global digital value chain. She underlines the potential offered by the exploitation of digital resources in re-engaging peripheral regions, while exploring and respecting regional diversity. She adopts an innovation economics approach to digitization to explore the role of cultural or memory institutions – a term that groups archives, libraries and museums as well as content providers. Consistently, she highlights the opportunities for economic growth arising from the commercial exploitation of digital cultural assets in the media, tourism and education industries.

For the publishing sector, Benghozi and Salvador<sup>12</sup> investigate the new digital ecosystem and the investment strategies carried out by editorial houses in terms of R&D partnerships and new technological innovations. They aim to understand which economic actors are taking charge of this challenge, where they are located in the value chain, and how they are articulated with content producers.

Bugge and Øiestad<sup>13</sup>, following the related-variety approach, study the effects of digitization in the publishing industry and how this affects innovation and regional development. They find three modes of knowledge re-combination, all

<sup>4</sup> Bakhshi *et al.* 2008; Cunningham 2013.

<sup>5</sup> Benghozi, Paris 2007; Rayna, Striukova 2014.

<sup>6</sup> Lan 2004; Adner 2006.

<sup>7</sup> Casprini *et al.* 2013.

<sup>8</sup> Zott, Amit 2007.

<sup>9</sup> Lazzeretti *et al.* 2011.

<sup>10</sup> Chapman 2000; Bruno *et al.* 2010.

<sup>11</sup> De Laurentis 2006.

<sup>12</sup> Benghozi, Salvador 2013.

<sup>13</sup> Bugge, Øiestad 2014.

of which reflect some of the dynamics unfolding in that industry, as well as the epistemic bridging that links the old and the new in the economy.

In the museum sector, Camarero and Garrido<sup>14</sup> analyse the mediating role of technological and organizational innovation between market orientation and socio-economic performance in Spanish, French, British and Italian museums. They find a correlation between technological innovation and museums' economic performance, where the latter refers to their indirect economic effects, such as the increased attendance at the physical museums, as identified by curators' self-evaluation. Likewise, Bakhshi and Throsby<sup>15</sup>, despite initially claiming for a technology-driven revolution in the value creation process of cultural institutions, do not find evidence of online BMs being implemented at the Tate Gallery, and conclude by hypothesizing the existence of some indirect effects, like increased attendances and enhanced brand visibility. Consistently with her view of digital heritage as an exchangeable good, Navarrete<sup>16</sup> has attempted to classify digital-only BMs through an analogy with the domain of digital media, and identified five types – selling online spaces to advertisers, selling physical products online, digital commerce, subscription-based environments, and online donor programs – of which, however, only the third is directly related to digital objects and seems compatible with the mission of cultural heritage institutions.

A more articulated analysis has been recently provided by the Bertacchini and Morando's paper<sup>17</sup>, which discusses four BMs for digital collections based on current experiences at leading heritage institutions. The authors identify four archetypal BMs for access to and use of digital images of artworks, namely online display, proprietary licensing, open licensing and user-generated art images. The authors identify an underlying tension between the objectives of increasing access towards, and extracting revenues from digital collections, highlighting a lack of sustainable BMs based on open access – an aspect also highlighted with reference to digital libraries<sup>18</sup>. A similar trade-off between diffusion and revenue generation is also emerging for the case of multimedia tours and mobile applications, as «experience to date has shown that apps and other mobile products that are free to the end-user achieve greater usage rates than those with a charge»<sup>19</sup>.

The main approach to digitization emerging in the European context is mainly comparable to a *pipeline* or *digital value chain* model (fig. 1), wherein digital heritage contents are produced in the museum for collection management

<sup>14</sup> Camarero, Garrido 2008; Camarero *et al.* 2011.

<sup>15</sup> Bakhshi, Throsby 2010.

<sup>16</sup> Navarrete 2013.

<sup>17</sup> Bertacchini, Morando 2013.

<sup>18</sup> Chowdury 2013.

<sup>19</sup> Burnette *et al.* 2011.

purposes and then disseminated through the Web<sup>20</sup>. Instead, in North America and in Canada it prevails a participatory perspective, a *co-construction* approach to digital applications, wherein museum professionals are involved not only in the mere provision of contents, but also in concept design, whilst technology developers exert in turn a strong influence on curatorial choices of display and communication<sup>21</sup>.

In this scenario the present work aims to investigate the adoption of ICT and innovation processes in museums, and their interaction dynamics between the different communities of specialists (museologists, marketers, technology developers, etc.) involved in digitization projects, within and outside the museum. By this, it is meant to contribute to the recent debate on the new BMs for settings located in cultural clusters. We analyse an Italian successful museum case study, the Uffizi Gallery in the city art of Florence, where digitization has been conceived for the development and dissemination of digital collections, in a long-term partnership between the local University, a creative ICT enterprise (Centrica srl) and other technical partners, originating not only new digital cultural products, but also some cross-fertilization evidences.

According to a long-term case study methodology, we analyse the digitization process since its beginning until the end of 2013. The research site selected is one of the oldest and most important museums in Europe, the Uffizi Gallery in Florence, where digitization strategies mostly concern the implementation of digital collections and mobile applications.

Multiple sources of data (semi-structured interviews with information from websites, internal documents, publications, and institutional communication of the museum) were collected in order to reconstruct the digitization process. A total of four interviews were conducted during June 2012-October 2013 with the technologists at the University of Florence who collaborated with the museum in the first phase of digitization (late 1980s-1990s), with the main external partner (Centrica srl) which started collaboration in the 2000s, and the museum management. Interviews with technology developers aimed to understand the technological and economic aspects of the process, whereas interviews with the museum's management focused on the internal perspective about the digitization process and its role within the overall marketing and communication strategy.

After the present introduction, the paper is organized as follows. In section 2 we present the main evolutionary trajectories in digitization. In section 3 we focus on the digitization innovation process in the Uffizi Gallery of Florence; we analyse the different phases (computerization and commercialization) and the interaction between the museum and its main industrial partners. Finally, we conclude discussing the implications in terms of BM innovation for both the Uffizi Gallery and the creative firms involved in the digitization process.

<sup>20</sup> Kéfi, Pallud 2011.

<sup>21</sup> Soren, Lemelin 2004; Proctor 2010.

## 2. *The Main Evolutionary Trajectories in Digitization*

Digitized copies of cultural artefacts present some characteristics which open up opportunities for differentiated applications in the fields of safeguard, distribution and fruition<sup>22</sup>.

Over the last decades, museums have had to face increasing social and economic pressures, and different proposals for a reformation of their societal function have been advanced<sup>23</sup>. In particular, recent literature calls for a more explicit involvement of local communities and visitors through the provision of emotionally challenging experiences, also in relation to the variety of visitors' backgrounds and agendas<sup>24</sup>.

The introduction of new technologies of information and communication (ICT) has been advocated as a fundamental support to the reorganization of museums<sup>25</sup>.

Since the 1990s, the diffusion of interactive multimedia tools has opened new opportunities for enabling people to select the information contents desired and for recreating immersive and stimulating experiences<sup>26</sup>. In the 2000s, the emergence of cyber-museology has enabled online access to museum collections, whilst de-constructing academic criteria of classification and linear representations, allowing visitors to associate and remix exhibits according to personal meanings<sup>27</sup>. In Europe, the digitization of museum collections has been explicitly advocated by national governments and the EU and have been accordingly financed so far mostly by public funding. In particular, through the DIGICULT project concluded in 2002 (European Commission, 2002), the EU has aimed to assess the social potential of digitization and to coordinate the projects carried out individually by single governments and institute by defining common guidelines and standards. This has resulted in the creation of a common digital library (Europeana, released in 2008) that would gather all the collections of European libraries, archives and museums as one of the building blocks of a Single Digital Market<sup>28</sup>. The delivery of digitised contents to Europeana has been implemented over the last 5 years through European research projects and thematic networks, with an overall funding of 140.1 million euros in the 2009-2013 period (our elaboration on European Commission data), although economic sustainability has represented a sensitive issue since the start<sup>29</sup>. Moreover, the EU has strongly endorsed the idea that

<sup>22</sup> Cignoni, Scopigno 2008; Guttertag 2010.

<sup>23</sup> Anderson 2004.

<sup>24</sup> Kotler, Kotler 2000; Witcomb 2003.

<sup>25</sup> EC 2002.

<sup>26</sup> Barry 1999.

<sup>27</sup> Cameron 2003

<sup>28</sup> EC 2012.

<sup>29</sup> CIPFA 2009; Stroeker, Vogels 2012.

digitized items and metadata should be made public on an open basis in order to enhance access to the collective memory and economic benefits for the cultural and creative industries through the “re-use” of digitised contents<sup>30</sup>. However, European projects for digitization of cultural heritage are facing the growing competition of leading IT companies such as Google, which has approached the digitization of librarian documents in 2005 with Google Books Search and of museum collections with the Art Project in 2011, which aims to create a meta-collection of leading museums in the world.

Most recently, the focus of the discourse regarding the impacts of IT on museums has shifted from the mere digitisation of collection towards the creation of two-way interactions between the museum and its audience, as well as the sharing of experiences among visitors. This should be seen in connection with the advent of the Social Web, including new systems of interaction ranging from forums and blogs to social media, which especially in Northern America<sup>31</sup> have been emphasized as an opportunity for the formation of online communities who engage in the exchange of knowledge and personal interpretations. However, until recently Web 2.0 facilities have found limited applications in Europe due to a certain resistance by museums in letting go of their authority on the interpretation of the objects<sup>32</sup>. Only in the last years, museums in Italy have started engaging consciously with these opportunities<sup>33</sup>, also under the influence of the initiatives enacted by independent online communities such as *Invasioni Digitali* (Digital Invasions<sup>34</sup>). The aim of developing online communities and networks engaged in the creative re-use of digitised cultural contents has been also embraced by Europeana through initiatives such as *EuropeanaCreative* and *EuropeanaSpace*, also in order to attract alternative revenues to compensate decreasing EU funding<sup>35</sup>. The main evolutionary phases of digitization of cultural heritage are summarized in figure 2.

A series of parallel or intersecting trajectories of development emerges, leading to an ongoing convergence of their multiple courses (digital collections, multimedia tours and Web 2.0 facilities) towards mobile platforms. This platform is opening unprecedented opportunities for heritage institutions to provide customized interpretive facilities, thanks to a closer integration of different media and functions. Visitors can access location-specific contents, tag the artworks, visualize suggestions for further visit and share comments with other users, or save resources for later consultation through bookmarking facilities. However, this potential multiplication of contents and functions has opened a new array of issues to be addressed, regarding the modalities of

<sup>30</sup> Comité de Sages 2011.

<sup>31</sup> Soren, Lemelin 2004; Proctor 2010; Simon 2010.

<sup>32</sup> Lopez *et al.* 2010; Fletcher, Lee 2012.

<sup>33</sup> Bonacini 2012; Lazzaretti *et al.* 2015.

<sup>34</sup> <<http://www.invasionidigitali.it>>, 02.11.2016.

<sup>35</sup> Europeana 2012.

delivery for differentiated informational contents in specific spatial and temporal settings (pre, during and post-visit), the choice of language and tone of voice, or the role of visitor agency *vs* curatorial authority and social interactions.

In sum, in the first historical phase the digitization of cultural artefacts and museum collections (2D digital format) was mostly considered as a means to spread access to cultural contents and enable an «unlimited audience»<sup>36</sup> to enjoy replicas of artefacts and museum environments from a distance through the Internet, thus avoiding the spatial and temporal limitations of the actual visit to heritage sites or museums. However, the emergence of new technological trajectories such as multimedia exhibits, Web 2.0 spaces, virtual reality models and mobile applications has fostered the emergence of a debate regarding the impact of ICT on the interpretation and co-creation of cultural heritage.

### 3. *The Digitization Process in the Uffizi Gallery, Florence*

The Uffizi Gallery is one of the most ancient and important art galleries in Italy and Europe. The building was designed and realized in 1560 by Giorgio Vasari under the commission of Cosimo I Medici as a headquarter for the judiciary administration (“Uffizi”) of the Duchy, next to the family residence Palazzo Vecchio<sup>37</sup>. The Uffizi Gallery has been declared national museum since the Italian Unity in 1861, and is currently part of the *Polo Museale* (Museum Systems) of Florence, administered by the Superintendence for Architectural, Landscape, Historical, Artistic and Ethno-anthropological Heritage of the Province of Florence, Pistoia and Prato, an administrative branch of the Ministry of Cultural Goods and Activities. Stably featuring among the 10 most visited museums in Italy, the Uffizi Gallery has experienced a substantial stability in visitor numbers – on average, about more than 1.25 million paying admittances per year, with a slight increase after 2005<sup>38</sup>. This important site is situated in one of the most important Italian museum cluster<sup>39</sup>, in a district specialized in high technology applied to cultural goods, tourism and Made in Italy manufacturing<sup>40</sup>.

<sup>36</sup> Keene 1998.

<sup>37</sup> Barocchi, Ragionieri 1982.

<sup>38</sup> MIBAC 2012.

<sup>39</sup> Lazzeretti, Cinti 2009.

<sup>40</sup> Casprini *et al.*, 2014

### 3.1. *The computerization phase: from the Uffizi Strategic Project to the DADDI project (1989-2005)*

#### *a) The Uffizi Strategic Project*

The first formalized project of computerization at the Uffizi Gallery dates to 1989, when the State Archives hosted in Vasari's building were moved to another location and their vacant premises were allocated to the museum. The Uffizi Strategic Project was thus launched by the Superintendence and the Director of the museum with the aim of upgrading and adapting the newly acquired areas for exhibition purposes, allowing at the same time a further expansion of the museum. The project included four main axes of intervention, specifically: a) the monitoring of environmental conditions in the exhibition rooms; b) the analysis of the state of conservation of artworks; c) the automation of data collection; d) their remote diffusion. Each of these fields offered an opportunity for testing and validating innovative techniques developed by the projects' scientific partners: the Department of Information Engineering of the University of Florence (DIE) and the National Council of Research<sup>41</sup>.

The Uffizi Strategic Project demonstrated the willingness of the public cultural administration to experiment with innovative technologies adopted at the time by local research labs (a case of cultural cluster and technological district).

In particular, digital imaging had represented one of the main areas of specialization of DIE for almost two decades, having emerged from the convergence of optics, electronics and computer sciences. Since the late 1970s, a Lab of Digital Images had been operating within the Department to experiment and validate the acquisition of 2D digital images. In this early phase of research, cultural heritage was considered as a relatively new field of application with respect to more established ones (processing of X-ray radiography and nuclear body scanning, remote sensing of terrestrial resources and robotics). In this context, the main potential for the computer was identified in the totally objective acquisition of artwork images, from which the geometrical modules and mathematic proportions underlying the composition could be extracted through suitable digital filters<sup>42</sup>.

The first tests had been conducted autonomously at the Lab since the late 1970s yielding technically encouraging results, which allowed the developers to sensitize cultural professionals about these potentials through scientific publications and also personal contacts with art curators. In this context, the strategic project provided the first opportunity for conducting tests in collaboration with a museum, which was formalized through the establishment

<sup>41</sup> Cappellini 1993.

<sup>42</sup> Cappellini *et al.* 1978.

of a Department of New Technologies for Artworks (DNNTA) at the Uffizi, with the mission of transferring digital imaging expertise from DIE to the users.

*b) The RAMA and MUSA Esprit Project*

In 1994, the partnership was strengthened through the joint participation of the Uffizi, DIE and SIDAC-STET (a branch of the State-owned IT group FINSIEL, then acquired by the Telecom Italia group) to two pilot European projects of museum automation and digitization, namely Remote Access to Museum Archives (RAMA) and MUSA-ESPRIT. The former had the objective of connecting the existing databases of leading European museums through telecommunication networks, enabling different forms of research and data exchange from remote, such as the consultation of catalogue records based on text fields, the sharing of results of diagnostic campaigns, and the request of licences for using contents for publishing purposes<sup>43</sup>.

With respect to RAMA, MUSA-ESPRIT focused more specifically on the development of digital imaging techniques for the remote diffusion of cultural contents, especially with the aim of improving the links between museums and the publishing sector within the value chain of multimedia publishing. The main achievement of MUSA was the development of the “VASARI” scanner by DIE and its installation at the Department of Technologies of the Uffizi. VASARI consisted in a black-and-white, high-resolution (300 ppi) camera connected to a multi-spectral (7 bands) system of digital acquisition that allowed to reconstruct colour images, and was characterized by a higher level of chromatic fidelity compared to earlier devices. This application was initially envisioned as a valuable support to preservation and restoration activities, fulfilling the necessity for the museum to gather a diagnostic expertise capable to converge into a database, in order to enable a “comparative” reading of artworks’ behaviour over time and their variation.

Within MUSA, a smaller version of the unwieldy equipment was developed by the British firm “Time and Precision” under the guidance of DIE and the National Gallery. A software system of colour certification was developed, which enabled to compare the colour of digital images with that of “real” artworks. The resulting digital images were thus inserted into the Uffizi database (developed by SIDAC-STET within RAMA) and made accessible to members of the network.

The achievement of these goals also marked the end of the experience of the Department of New Technologies for Artworks, which was deemed to have successfully accomplished its function and was discontinued in 1999.

<sup>43</sup> Cappellini *et al.* 1995a.

*c) Centrica srl spin off and DADDI Project*

In 1999, Marco Cappellini and three other partners established the firm Centrica srl, which was to catch the opportunity offered by the rise of Internet, digital imaging and multimedia applications, focusing on cultural heritage.

The main initiative in this period was the Digital Archive through Direct Imaging (DADDI) project, started in 2000 by the Uffizi, DIE and Centrica, with the technical sponsorship of Phase One A/S (Denmark), and the financial support of Toppan Printing Co. Ltd (Japan). The project aimed to define a standard procedure for the direct digital acquisition and processing of artworks involving functions such as lighting control and chromatic correction. The project involved the acquisition of all the artworks exhibited at the Gallery at a minimum spatial resolution of 8000 x 8000 pixels and their insertion in a digital archive in multiple resolutions for specific types of utilization (research, restoration, database management, etc.)<sup>44</sup>.

The actual acquisition phase was performed by Centrica, under the guidance and supervision of the Uffizi and DIE and using hardware and software equipment provided by the technical sponsors (which were joined by a further leading Japanese corporation in the following phases of the project). As DADDI showed a more marked focus on the opportunities for diffusion and commercialization of digital images, copyright management issues were addressed by testing a “digital watermarking” technique – consisting in the insertion into the digital image of an identifying field that is invisible to the user, but can be easily tracked and decoded by the owner<sup>45</sup> so as to control the further utilizations of the file.

In 2007 started a new digitization project focused on masterpieces. The project, promoted by Hitachi-Centrica-MICC and still active today, is creating a set of very high-resolution images of works of art (1000-1200 ppi) in the *Polo Museale Fiorentino*, mainly from the Uffizi Gallery.

Between 2008 and 2009, digital images have been integrated into digital museum cards (i.e., the descriptive labels containing all the information related to specific artworks, including restorations and movements) for which a consultation software has been specifically developed by the firm Parallelo in order to simplify the retrieval and management of the collections<sup>46</sup>. Whilst the information are used internally for documentation purposes, they have also been made available to the public through a dedicated section of the website.

<sup>44</sup> Acidini, Cappellini 2008.

<sup>45</sup> Barni, Bartolini 2004.

<sup>46</sup> Sframeli, Parallelo 2009.

### 3.2. *The commercialization phase: technologies for distribution, fruition and cross-fertilization (2000-2012)*

#### *a) Technologies for distribution*

Whereas over the latest years DIE has further pursued the application of digital imaging techniques for preservation and virtual restoration<sup>47</sup>, Centrica has specialized in the development of computer-based systems for the remote distribution of digital images.

The first system of this kind was launched in 2000 with the name of *XLimage*<sup>®</sup>. It consists of an Internet server that enables the high-resolution visualization of digital artworks with different modalities (Intranet, Internet, mobile). It incorporates a colour management system that limits chromatic alterations in the migration across different devices, and a watermarking technique based on the insertion of an alphanumeric code in the file. Following the previous experience of collaboration, the Uffizi were one of the first adopters of *XLimage*<sup>®</sup>, using it for distributing images through the museum website.

The following advancements concerned the design of an integrated system of access to digital collections, which was launched in 2005 as *XLphoto*<sup>®</sup>. With respect to *XLimage*<sup>®</sup>, this product includes a set of additional features such as an automated and customized facility for the commercial licensing of cultural contents on the basis of a set of parameters (type and country of publication, exclusivity of use, size and position of the image in the publication) and a database-driven search engine (*XLspider*<sup>®</sup>) that enables to track digital watermarks.

As these characteristics promised to facilitate the distribution and licensing of digital images to the publishing industry, *XLphoto*<sup>®</sup> was experimented by the Uffizi to manage requests by external buyers.

The most recent direction in product development at Centrica has targeted the integration of software systems for the distribution of digital artworks with hardware interfaces, in order to provide a complete experience of fruition. To this purpose, a new product named *Ars Touch* was launched in 2008, consisting in a PC workstation that runs the *XLimage*<sup>®</sup> software, connected with a touch screen that allows the visualization in high resolution and the interactive exploration of digitized artworks. *ArsTouch* has been mostly used in cultural events at Florentine institutions to offer visitors the possibility to visualize paintings or other visual or textual materials.

<sup>47</sup> Cappellini *et al.* 2003.

### *b) Technologies for fruition*

The *ArsTouch* platform also provided the basis for the *Uffizi Touch*<sup>®</sup>, an interactive software application launched in 2010 that gives access to the museum's digital archive<sup>48</sup>. Through a touch screen available in three size formats ("totem", "wall" and "studio"), the system enables the visualization in high resolution (between 40 and to 150 megapixels) of over 1,100 artworks belonging to the collection, which can be searched and browsed by author, title, historic period and museum room – though de-contextualized from the actual museum environment.

The software has been entirely designed by Centrica and descriptive cards of the artworks in Italian and English have been realized by Centrica and verified by the museum, which has made an agreement with the firm under a royalty calculated as a percentage of the unit price of the installation. Starting from 2012, the system has also been distributed as a mobile application for iPhones, iPads and iPod Touch. An updated version of the *Uffizi Touch*<sup>®</sup> has been launched in 2012 with additional functions based on the new *XIKnowledge*<sup>®</sup> platform – developed by Centrica such as the thematic search facility and the dynamic suggestion of artworks according to specific iconographic elements, such as jewellery, landscape or pieces of furniture.

*Uffizi Touch*<sup>®</sup> is a good example to analyse the difference/similarity of perspective between curators *vs* technology developers over digitisation. From the curator's point of view, the technological instrument enables an accurate analysis of the artist's technique and the state of preservation of the pictorial surface, which in turn can support the diagnostic phase and the critical exercises. For technology developers it represents a new modality of fruition that overcomes the usual constraint of the physical visit (opening times, crowding, lighting conditions, etc.)<sup>49</sup>.

The comparison between the curatorial and the commercial perspective over the product highlights how the same technology may perform differentiated but complementary functions within the digital value chain, according to the schema proposed in figure 3, thus virtually intervening at the two ends of the process.

Moreover, *Uffizi Touch*<sup>®</sup> represents an exception within the current scenario of museum mobile applications because it works mostly before and after the visit. The mobile applications and smart-phones provide first of all information for visit planning purposes (opening hours, ticket fees, events, etc.); then they include multimedia resources and interpretive tools (descriptive cards, audio tours, podcasts, videos, etc.) assisting the visit experience<sup>50</sup>; finally, in

<sup>48</sup> Cappellini *et al.* 2010.

<sup>49</sup> Cappellini 2010.

<sup>50</sup> Burnette *et al.* 2011.

the post-visit phase, they offer opportunities to expand one's knowledge of specific or related artworks at home. To this purpose, bookmarking facilities have been introduced through which the visitor can select artworks and related interpretive materials to be consulted after the visit on the museum website<sup>51</sup>. A parallel direction of development refers to social interaction facilities, like the sharing of comments with other visitors through social networks, either in real time or after the visit<sup>52</sup>.

Consistently with their focus, so far *Ars Touch*<sup>®</sup> and *Uffizi Touch*<sup>®</sup> have best deployed their potential in situations that are unrelated or substitutive to the actual museum experience,<sup>53</sup> but also as a promotional opportunity for Italian heritage (see figure 4).

The peculiar character of *Uffizi Touch*<sup>®</sup>, within the museum app scenario is indirectly confirmed by the fact that, in the same period, the *Polo Museale* authorized another mobile application named *Uffizi* by the local web communications firm Parallelo, which has also developed the system of consultation for digital museum cards and the museum website. The product is based on the software platform *Ars First Guide*, which combines three functions: mobile tour guide, digital collections and educational tools.

The application includes four modalities of exploration: *map*, which displays the most representative rooms of the museum and lists the exhibited works; *works*, which enables the visualization of 33 masterpieces from the collection with related descriptive cards; *museum*, providing practical information for visit planning such as opening times, ticket fees, directions and reservations; *news*, including a calendar of the events at the museum. Similarly to *Uffizi Touch*<sup>®</sup>, a smaller selection of images in high resolution belonging to the digital archives and descriptive texts are provided by the *Polo Museale*.

The promotional material presents its possible functions before, during and after the visit, stressing more complementary than alternative utilizations (Parallelo). In this light, the two applications seem to intervene in distinct contexts, allowing the museum to differentiate its interpretive and promotional strategies: whereas *Uffizi Touch*<sup>®</sup> represents a sort of virtual replica of the museum, *Uffizi* mostly acts in support to the physical visit experience.

Consistently with their focus, *Ars Touch* and *Uffizi Touch* have best deployed so far their potential in situations that are unrelated or substitutive to the actual museum experience. As an example, in one of its first public presentations in 2009, *Ars Touch* screen installations were used to create a virtual gallery at the Baptistery of Pistoia where a selection of artworks from the *Uffizi* and

<sup>51</sup> Marty 2011.

<sup>52</sup> Proctor 2011.

<sup>53</sup> In 2010, the *Uffizi Touch* was selected by the Commission of the Italian government for the World Expo 2010 to implement *Uffizi*, a virtual exhibition for Shanghai Art Museum. In 2012, a series of virtual exhibitions were organized in Japan and Centrica inaugurated a dedicated "Space Italy" section at the National Museum of China in Beijing.

other collections were displayed. Similarly, the following year Uffizi Touch was selected by the Commission of the Italian Government for World Expo 2010 in Shanghai to realize, in partnership with national and regional institutions, the Virtual Uffizi exhibition at the Art Museum of Shanghai (June 27 – July 21 2010) where a selection of artworks was displayed through nine large touch screens, receiving a total of 35,000 visitors in 25 days. A series of virtual exhibitions organized in Japan in partnership with Hitachi Ltd. at the Institute of Italian Culture in Tokyo in November-December 2011, at the Tokyo Fuji Art Museum, the Kyoto University Museum and the Hitachi DIS Showroom in Yokohama followed in 2012. Here, besides the navigable digital collections, 10 life-size replicas of masterpieces and a digital theatre composed of 5 wall screens projecting works and a virtual tour of the museum were added, achieving a satisfactory results of attendance. In July 2012, Centrica has inaugurated a dedicated “Space Italy” section at the National Museum of China in Beijing, where narrative videos and interactive touch-screen installations presenting the geography and history of Florence are displayed as a complement to virtual replicas of artworks. Other virtual exhibitions have then been organized, most recently the Uffizi in Milan (Uffizi Virtual Experience in Milan, Fabbrica del Vapore (January 22 – March 10 2016) which contains an immersive section with large-sized digital images of the artworks, and an interactive one with touch-screen workstations that provide the zooming and thematic navigation features of *UffiziTouch*®.

*d) The role of digital collections within the Uffizi’s communication strategy*

From the reconstruction of the digitization process provided above as well as from the interviews, in the museum’s perspective, the digital value chain substantially replicates the production process of analogue contents (such as the organization of a physical exhibition), with the exception that the contents are translated into a digital format and then disseminated through digital channels.

This view is confirmed by the fact that the digital collection in *Uffizi Touch*® substantially replicates the curatorial setting of the physical museum, and that the virtual exhibitions organized in partnership by the Gallery and Centrica have been conceived to provide an interactive and immersive experience that extends the one that can be enjoyed at the museum.

Such an approach is grounded in a specific museological perspective, which sees the main task of museum curators and staff as that of providing complete and historically authoritative information and interpretations about the artworks. It is rather surprising, however, that in this perspective – in opposition to early concerns with the possible «lost of the aura» of the original artwork entailed

by the proliferation of digital copies<sup>54</sup> – the adoption of digital communication channels is seen as a favourable opportunity for spreading awareness and knowledge of the museum's collections<sup>55</sup>, enabling users to enjoy a deepness of appreciation that is usually available only to museum curators. As the Director of the Gallery notices, the unprecedented possibility of appropriating a faithful reproduction of the collections may have two opposite effects on the user, that is either a “healthy” relativization of the cult for the authentic, or instead an increased veneration of the masterpiece as a “relic” (personal communication). The relative enthusiasm for the opportunities enabled by digital channels is confirmed by the fact that the Uffizi have been the first Italian museum to subscribe to Google Art Project in 2011, where a first selection of 73 digital artworks and a virtual tour of selected rooms have been made available. It should be remarked, however, that the digital watermarking system developed by the University allows the museum to maintain control over the diffusion of its digital collections, avoiding the negative consequences of uncontrolled proliferation. In this light, the Uffizi have chosen an opposite business model to the open release of digital collections and metadata that is being encouraged by the European Commission: in this sense, if the museum was to adhere to the “cultural commons” policy currently pursued by Europeana, it would have to renounce to a significant source of revenues and let go of part of its control over the use and re-use of digital contents.

With its focus on the «quality and quantity of data inserted on-line»<sup>56</sup>, moreover, the web communication strategy of the Uffizi and the whole Polo Museale Fiorentino has remained until recently largely unaffected by the recent shift of emphasis towards interaction and co-creation with online communities<sup>57</sup>. As an example, the official website of the Polo did not offer until recently spaces of discussion nor links to social network profiles, except a YouTube channel opened in 2011 to broadcast curatorial presentations and videos related to museum activities.

Besides the willingness to preserve the museum's reputation as a trusted source of knowledge, a further cause for limited engagement with the Social Web lies in the rigidity of organizational charts in the Italian cultural

<sup>54</sup> Besser 1997, for example.

<sup>55</sup> This objective has not been pursued exclusively through the adoption of online communication channels, but also through physical initiatives among which the series of exhibition “La Città degli Uffizi” (2011-2014), <<http://www.lacittadegliuffizi.org>>, 20.08.2016. This consisted in an innovative format where artworks held at the Gallery (including pieces that cannot be exhibited regularly and are conserved in the depots) were temporarily exhibited in their original environment together with works belonging to the same artist or period. Besides spreading knowledge of the museum's collection outside its walls, this initiative also aimed at reconnecting the artworks with their historical place and period of origin, so (temporarily) reversing the “loss of context” that has affected Italian cultural heritage due to the process of musealization.

<sup>56</sup> Acidini, Cappellini 2008, p. 26.

<sup>57</sup> Proctor 2010, Simon 2010.

administration, where hybrid figures such as social media managers can be hardly accommodated. In the case of the Uffizi, these constraints have been partially avoided by outsourcing web communication and the design of mobile applications to private partners, with the side effect of reducing the opportunities for cross-fertilization of competences and communication strategies between the museum staff and the IT community.

In August 2015 a new museum Director has been appointed, coinciding with a broader reformation enacted by the Ministry of Culture in order to renovate Italian museums which has attributed a larger organizational and financial autonomy to individual institutions. Therefore, the Uffizi may bring major changes to their web communication strategy, also thanks to the increased organizational flexibility that could allow introducing specialised professional figures.

#### 4. *Conclusions*

Concluding this analysis of the digitization process at the Uffizi Gallery, we would like to underline some particularly interesting results in terms of the debate on the digitization of cultural heritage, BM innovation and eco-systems in cultural settings.

First, the case of the Uffizi provides significant empirical evidence of application of the digital value chain model as described by De Laurentiis<sup>58</sup>. The process of digitizing art collections is conceived and implemented without particular strains, as the result of a fruitful collaboration in which museum curators are able to combine technical and cultural competencies developed by working with both the University and local firms.

In the first period (1989-2000), the digitization of collections for documentation and research purposes was implemented through special projects, and experiments of knowledge transfer were put in place. Later on (2000-2013), there was a completion of digitization and knowledge transfer, with a shift of focus to public access and commercial use (mobile applications and virtual exhibitions). This stage was carried out for the most part autonomously by the private partners. Along the digitization process, however, different and complementary perspectives were carried by the museum staff and technology developers: for the former, digitization supports diagnostics and critical exercises, whereas for the latter it represents a new modality of fruition that overcomes the usual constraint of the physical visit. In general, the long-standing partnership between the Uffizi and software developers seems to have been goal-oriented, focusing more on the definition and implementation

<sup>58</sup> De Laurentiis 2006.

of high-quality digitization techniques rather than on the experimentation of innovative communication strategies.

From a museological and epistemological viewpoint, the value chain or *pipeline* model adopted in the case study emphasizes the scientific rigour of the reproductions and metadata inserted into the Web, according to a view of communication as a one-way process of data transmission from an authoritative source to the audience. This view, however, may run into contrast with the growing emphasis on the co-creation of cultural values with online communities that underpins the Social Web discourse<sup>59</sup>.

From an economic standpoint, in the case study the partnership with the University and private firms has enabled balanced funding to the digitization process, differently from the general European scenario, where established reliance on public funding is leading to a serious challenge of long-term sustainability<sup>60</sup>. The BM adopted by the Uffizi, however, is in open contrast with the “commons” model advocated by the European Union and Europeana in order to encourage the use and re-use of digitized cultural contents by the creative industries<sup>61</sup>. In this context, the long-term impacts of the increased availability of new technical instruments for the negotiation of licensing agreements<sup>62</sup> and the control of subsequent uses of digital images, such as the digital watermarking system developed by DIE, should be further assessed.

From a technological standpoint, the case study confirms the ongoing convergence of multiple trajectories (digital collections, multimedia tours and Web 2.0 facilities) towards mobile platforms, as already evidenced in museological and technical literature (section 2).

It should be remarked that the digitization of the Uffizi Gallery was made possible not only by a long-term public-private partnership, but also by the strategic role played by the territorial context in which the museum is located, i.e. a cultural cluster in a world-renowned city of art as well a technological district specialized in cultural goods, a combination that literature on local development has already widely explored<sup>63</sup>. In this context, the Superintendence and the University both played a key part, which, together with the museum and the software developers allowed to realize noteworthy technological innovations. Social and cultural as well as economic relations favoured exchanges and collaborations fuelled by a common sense of belonging and trust, and by a strong entrepreneurship that stimulated some relevant spin-offs from the university context. Such an ability of culture to generate ideas and innovations corroborates the assumptions laid out in literature on cultural and

<sup>59</sup> Simon 2010, Bonacini 2012.

<sup>60</sup> CIPFA 2009, Stroeker, Vogel 2012.

<sup>61</sup> Europeana 2012.

<sup>62</sup> Bertacchini, Morando 2013.

<sup>63</sup> Lazzeretti *et al.* 2011, Casprini *et al.* 2014.

creative economy, which assign creative industries a strategic role in facing the crisis<sup>64</sup>.

The current challenge for the digitization of cultural heritage consists in matching the respective interests of museums and software developers, on one side, in reaping the economic benefits of digital collections, and those of users, on the other side, in enjoying freedom of use and re-use. New emerging technologies such as mobile platforms and the growing impact of social networks are calling for new models to balance the curatorial approach with a participative approach<sup>65</sup>. In this sense, digitization appears as an evolving phenomenon that deserves to be put under constant observation.

The possibility of inferring general conclusions from the empirical case study is limited by the methodology adopted. Therefore, comparisons with other relevant experiences of leading cultural institutions can shed further light on the challenges and implications of the digitization process. Lack of quantitative data regarding the economic (e.g. number of downloads, revenues generated for the museum and private partners) as well as cultural (e.g. interaction of users with specific contents etc.) impacts of the digitization process is another major limitation.

As regards further research directions, more comparative studies at an international level are needed to provide an economic evaluation of the economic and cultural benefits that museums, technology developers and users receive from digital collections. This may benefit from the adoption of mixed methods methodologies that combine multiple sources of empirical evidence such as revenue flows, numbers of accesses and downloads, customer perceptions, etc.

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<sup>64</sup> Bakhshi *et al.* 2008.

<sup>65</sup> Pescarin *et al.* 2012; Proctor 2011.

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Appendix

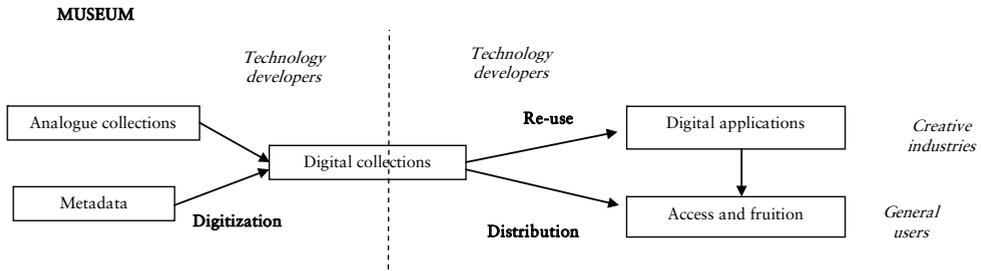


Fig. 1. Museum digital value chain (source: our elaboration)

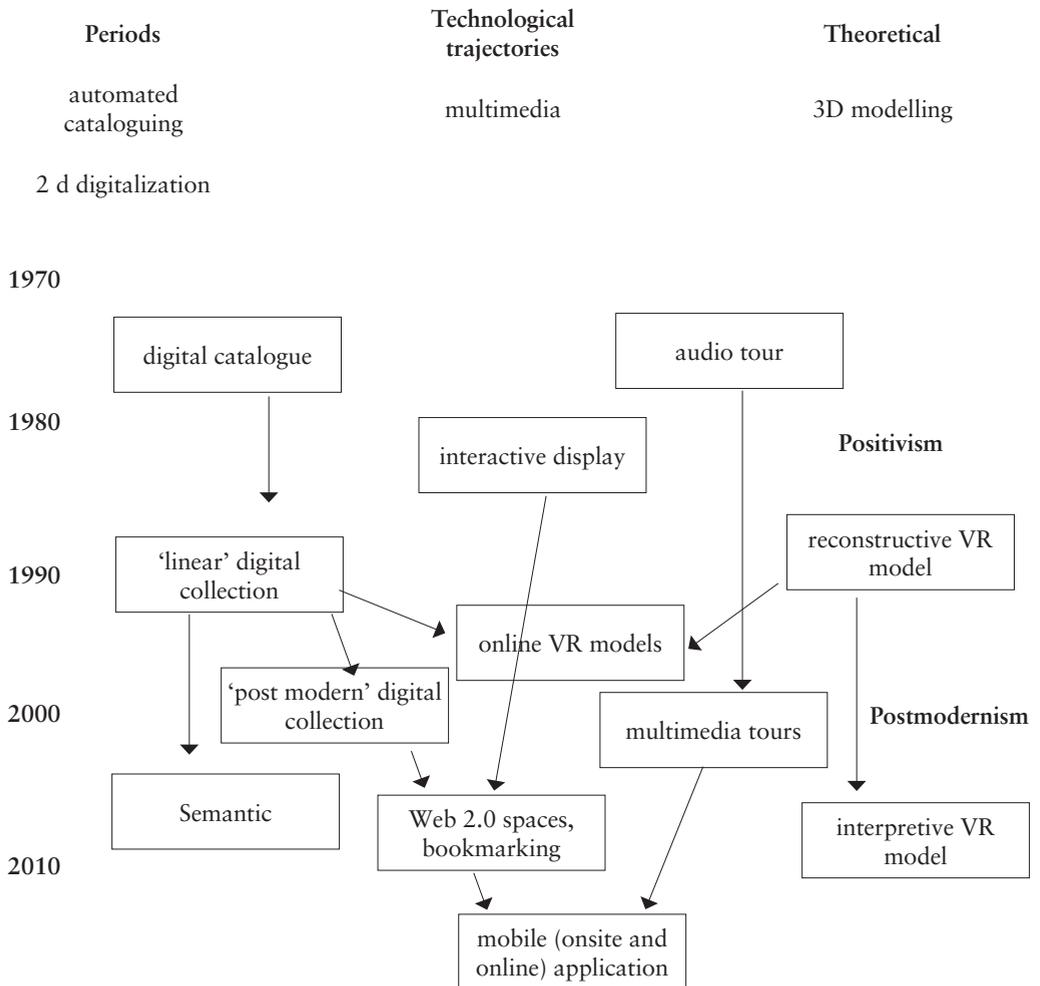


Fig. 2. A multiple and partially intersecting techno-cultural trajectories in digitization (source: our elaboration)

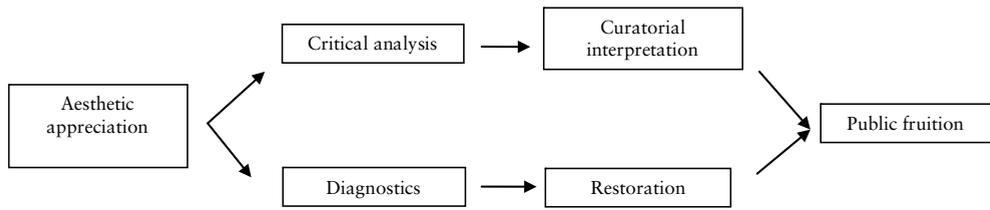


Fig. 3. The functions performed by Uffizi Touch within the cultural heritage “value chain” (source: our elaboration)



Fig. 4. Picture from a virtual exhibition organized by Centrica at Shanghai (2010) (<<http://www.centrica.it>>)

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