Digital Resources for Manuscripts: Between Fragmentation and Development Prospects

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The Current Situation in Italy

Between 2016 and 2020, the Italian Ministry of Culture allocated a total of 35.6 million euros to the digitization process and technological innovation out of a total allocation of 747 million euros, or 4.6 percent of the total allocated to it in the national budget.[1] The repeated lockdowns due to the pandemic emergency, and the subsequent economic crisis, have made it more urgent than ever to rethink the function of cultural sites and open them up to the community through the rapid implementation of digital strategies.

With fifty-five UNESCO World Heritage Sites as of 2020, the Italian culture and tourism sectors account for 12 percent of the gross domestic product and generate from 6 to 15 percent of total employment. The Court of Auditors has identified 163 cultural institutions (central institutes, regional secretariats, superintendencies, regional museum directorates, management offices and autonomous institutes) spread throughout the country.

In terms of quantity, the achievements in cultural-heritage digitization are impressive: more than 37 million catalogue descriptions with about 26 million images, counting only the national information systems collection. This digital information has been consulted by more than 100 million unique visitors in the last five years. Although the digitization of cultural heritage appears to be vast, some critical questions emerge from the survey. For example:

– Museums are using internal personnel or are relying on external consultants.
– Sixty-four percent of museums do not have in-house professionals with digital skills.

[1] All data in this section are drawn from Corte dei Conti 2022.

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– The progress in digitization is very uneven, ranging from 21 percent of institutions that have not carried out any digitization at all to 23 percent of institutions that have digitized more than 75 percent of their collections.
– Although 68 percent of museums claim to have a computerized cataloguing system, paper cataloguing is still widespread.
– Approved projects are often carried out using software that is or will soon be obsolete.
– Only 22 percent of respondents said they had reused software from another institution.
– Only 2 percent have joined the AgID cloud enablement program (national cloud program).
– Only 15 percent joined the National Museum System (NMS), which is responsible for the management of cultural heritage.
– The majority of Web sites offers static content, while forms of interaction with users are still underdeveloped.
– Many Web sites of well-known institutions use only English as an alternative to Italian.
– Forty-eight percent of Web sites are not compatible with mobile devices.
– Only 20 percent of museums offer online ticketing services.

The recommendations of the Court of Auditors were taken into account during the formalization of the PNRR (see below), with the broad objective of orienting digitization not only toward the preservation, protection and management of scientific knowledge and cultural heritage but also toward its use and valorization by a wider user base.

Ensuring accessibility through user-friendly tools and resources, reducing inefficiencies, dematerializing paper archives and repositories, creating platforms for broad and integrated access to cultural-heritage information so as to ease the provision of digital services to citizens, tourists, schools, businesses and civil society, and ensuring use and reuse by cultural and creative industries and startups are just some of the suggestions made by the Court of Auditors.

1. Types of Digital Resources for Manuscripts

There are several types of digital resources for manuscripts, which can be divided into three macro-categories: Digital facsimiles for manuscript reproduction, digital scholarly editions (DSEs) in text-only format, and

DSEs that offer digital facsimiles together with diplomatic and/or interpretative transcriptions.

1.1. Digital Facsimiles

A digital facsimile is a copy of a manuscript or printed volume in digital form. All major Italian libraries have their own digital repositories. This result has often been achieved through autonomous funding initiatives and agreements with private organizations, which have enabled libraries to digitize their manuscript holdings. For example, the Vatican Library launched a project in 2012 to digitize its manuscripts, starting with a financial contribution from Pope Benedict XVI. The ambitious project aimed to digitize 80,000 codices, mainly from the period between the middle ages and Renaissance humanism. This result was made possible thanks to the agreements that the Vatican Library signed with individual companies. In 2014, for example, the agreement with NTT Data Corporation was fundamental: The company began to implement services related to digital archiving and the long-term sustainability of the digital repository. Currently, 24,805 volumes have been digitized and are available in the *DigiVatLib* digital library (Biblioteca Apostolica Vaticana, n.d.) in the digital collections section.

In addition to autonomous funding, some important projects have involved several libraries and led to cooperation among them. A significant number of digital facsimiles was produced in 2010 thanks to a major digitization program based on an agreement between the Ministry of Cultural Heritage and Activities (MiBAC)[2] and Google Books. Initially, the libraries involved were the Biblioteca Nazionale Centrale in Rome, the Biblioteca Nazionale Centrale in Florence, and the Biblioteca Nazionale Vittorio Emanuele II in Naples. The libraries' task was to assess the condition of the volumes and to prepare them for shipment, while Google set up a national scanning center to produce the digital facsimiles and to transport the volumes from the individual libraries to the scanning center and back. The digital facsimiles are available on the Google Books site and on sites owned by the MiC.

The Polonsky Foundation – a grant-making charity registered in the United Kingdom focusing on cultural heritage and digitization – has funded many projects over the years that have led several European libraries to collaborate with each other. For example, the Vatican Library

[2] Now the Ministry of Culture (MiC).

and the Bodleian Library of Oxford University collaborated to digitize many Greek and Hebrew manuscripts and incunabula that are now available online. The foundation also funded a project led by the Biblioteca Nazionale Centrale of Rome to digitize *incunabula* from Italian monastic libraries linked to national monuments: in June 2020, the first 206 digitized *incunabula* held at the Library of the Monastery of Santa Scolastica in Subiaco were published online.

The digital facsimiles of manuscripts produced through these projects and similar ones have been collected in the individual digital libraries and made available on the Web, but unfortunately, they are not connected with each other. So the digital libraries of the Biblioteca Nazionale of Rome (Biblioteca Nazionale Centrale di Roma, n.d.), of the Biblioteca Medicea Laurenziana (Biblioteca Medicea Laurenziana, n.d.), of the Biblioteca Riccardiana (Biblioteca Riccardiana, n.d.), and all the other digital libraries are "locked-in owners" of their digitized cultural heritage. Therefore, most Italian libraries have collected digital facsimiles produced in different periods and by different projects in their own portal. The resulting problem – the fragmentation of our digitized cultural heritage – has been partially addressed by the *Manus Onlin*e database (Manus Online, n.d.), which includes not only digital facsimiles of manuscripts held in different Italian libraries, both public and private, but also their metadata. For each manuscript, the database provides a bibliography, information about cataloguing, and the libraries holding the manuscript.

On an international level, the Swiss national portal *e-codices* (E-codices, n.d.) is an excellent example of a project whose purpose is to overcome the fragmentation caused by the different digital libraries created by single institutions by placing itself as a national portal for digitized manuscripts. It aims to provide free access to medieval and modern manuscripts of Switzerland: the portal collects digital facsimiles with metadata available in four different languages (Italian, French, German, and English). The Swiss libraries with the ten largest catalogues of manuscripts of the medieval and early modern eras established the selection criteria in 2010, and as of this writing, more than 2,500 digitized manuscripts are available. Each digital facsimile is accompanied by its descriptive metadata encoded following the TEI-P5 guidelines (TEI-P5 2023), available both in XML and PDF format. It is possible to visualize the digital facsimiles with the *Mirador viewer* (Mirador, n.d.), choosing a personal layout. The Web site provides all the information regarding completed projects, current projects, funders, guidelines for conservation, reproduction, and data security. *E-codices* is also a good example of a collaborative environment where everybody

can contribute to the final result. Registered users, for example, can add annotations on individual manuscripts with a specific tool, relying on instructions provided in PDF format. In 2014, the Web application was updated, and access to the portal is also possible using mobile devices (for example, smartphones).

1.2. The Digital Scholarly Edition

According to Patrick Sahle, "a scholarly edition is the critical representation of historic documents" (Driscoll and Pierazzo 2016, 23). A digital scholarly edition (DSE), while sharing the same goals as a printed edition, is not the same as a digitized version. Instead, it offers many advantages and overcomes some of the limitations of printed editions. There are different kinds of DSEs: those in text-only format and those that offer a digital facsimile of a manuscript together with the diplomatic and/or the interpretative transcription. For the purposes of this paper we are mainly interested in the latter.

The manuscript facsimile is generally the starting point for such a DSE, unlike traditional editions which are limited by space and/or economic constraints, and it represents a valuable resource for palaeographic and philological research. In addition, a printed edition usually provides only one presentation of a text, whereas a DSE can provide both a diplomatic and an interpretative level of transcription of a document. Other advantages include access to online resources to enrich the content of the edition and the possibility of linking DSEs together and allowing collaborative editorial work on them. There is also a strong push to make DSEs more interoperable, on the basis of the FAIR principles (GO FAIR, n.d.), and easier for the public to use.

With regard to DSEs in text-only format, many digital libraries collect them, usually on the basis of specific selection criteria. For example, they may focus on collecting texts by a single author or on a particular period or genre. For instance, the *Mirabile Digital Library* (Mirabile, n.d.) collects texts edited by SISMEL (Società Internazionale per lo Studio del MedioEvo Latino) and provides full-text search and cataloguing facilities. The *Perseus Digital Library* (Perseus Digital Library, n.d.) [3] collects a large number of texts of Latin and ancient Greek. *ALIM* (ALIM, n.d.) is a digital library of medieval Latin texts written in Italy. *Noscemus* (Noscemus, 2017-2022) is a database of scientific Neo-Latin texts classified by author, work, and

[3] Also see Berti 2019, 53-72.

bibliography. *DigiLibLT* (DigiLibLT, n.d.) is a database of Latin prose from late antiquity that allows the texts to be downloaded in various formats and users to participate, for example, by identifying errors and adding suggestions. The availability of text-only DSEs is, however, important from the perspective of linking together digital resources that are currently isolated (see section 3 below).

2. Main Issues and Possible Solutions

There appear to be three main problems with the sharing of digital cultural-heritage resources: fragmentation, long-term sustainability, and the fruition of such resources.

The first issue is fragmentation. As far as digital facsimiles are concerned, MiBAC tried to overcome the lack of consistency of the digitized heritage by opening of the *Biblioteca Digitale Italiana* (ICCU 2017) portal in 2007 and of the *Alphabetica* (Alphabetica, n.d.) portal in 2021. These two portals have made it possible to connect the digital objects of Italian cultural heritage, developing a national project that overcomes the limitations of each individual digital library. *Alphabetica* links digital facsimiles to databases containing the associated metadata and divides its digital objects into nine areas – protagonists, music, books, manuscripts, audios and videos, cartography, periodicals, graphics, and libraries. As far as manuscripts are concerned, the difference between the BDI and *Alphabetica* is that the latter provides a descriptive catalogue sheet for each manuscript. In fact, for modern manuscripts from the sixteenth century, there is a link to the corresponding sheet in the *Edit16* database (Edit16, n.d.), and for older manuscripts there is a link to the corresponding sheet in the *Manus Online* database. This ensures interoperability among the different databases.

Comparing these two portals, the transition from a first-generation digital library to a second-generation digital library is clear (Biagetti 2014). The main difference lies in the focus: while in the first case the focus is on the digitized objects to be stored, in the second case the emphasis is on the user and on easing access to relevant metadata. *Alphabetica* has the five elements which characterize a second-generation digital library: "open source software, social software, single sign-on, open standards, integrated Online Public Access Catalogue (OPAC)" (Kruk and McDaniel 2009, 79). The user-friendly interface, which divides the digital objects into categories, helps to customize the search. Registered users also have a personal area where they can save and store searches, collections, and digital objects.

There are two open access catalogues of DSEs: the *Catalogue of Digital*

Scholarly Editions created by Patrick Sahle in 2008 (Kruk and McDaniel 2009, 79), and the *Catalogue of Digital Editions* created by Greta Franzini in 2016.[4] Sahle's catalogue provides a brief description of each edition with a selected bibliography. Franzini's provides more detailed information for each edition, with a datasheet for each of them containing standard entries – script, historical period, language, start and end dates of the project, academic affiliation of the editor, intended audience, value of witnesses, language of the project's Web site, accessibility, and infrastructure. This kind of detailed datasheet may help to catalogue DSEs in a simpler and more systematic way, bringing together those that share common characteristics. Although the information in these catalogues is regularly updated, each scientific edition remains a separate project, not interoperable with the others. A portal listing all current (and future) DSEs, supported by the main cultural institutions, seems to be lacking.

The most logical solution to the fragmentation of Italian digital cultural heritage would be to create online frameworks linking different types of digital resources. For example, the *Atlas of Italian Digital Humanities*, a PRIN 2022[5] project led by the University of Bologna aims at creating an interactive knowledge graph of Italian digitized Cultural Heritage. Data mining methods will be used, and the data will be converted in a format based on the RDF standard[6], improving their searchability.

The second issue is long-term sustainability. Digital libraries that store the digital facsimiles are often created and funded by public institutions, especially libraries, which ensure the long-term sustainability of the digital resources. On the contrary, DSEs are often the result of individual research projects funded short-term, but regular funding is required to keep such projects going and available in the long term. Barats, Schafer, and Fickers use the expression "digital wasteland" for Web sites from all such projects, which then "are abandoned at the end of the project (…) and are no longer updated" (Barats, Schafer, and Fickers 2020).

Even when an institution provides for the sustainability of a project and of its data, it can often only cover data storage for a limited period of time. Moreover, when funds are plentiful, digital editions are often published on platforms created specifically for each project by a dedicated IT team. Elena Pierazzo uses a metaphor from the world of fashion to describe the

[4] For example, Manus Online, n.d., and Edit16, n.d.
[5] Progetti di rilevante interesse nazionale (PRIN) .
[6] Resource Description Framework (RDF) is a standard model for data interchange on the Web. For further information see RDF, n.d.

transition needed in the field of digital scholarly publishing: according to her, such a digital scholarly edition is comparable to a piece of haute couture because it is unique, uses specific tools and infrastructure, is extremely expensive, and is not for the majority of people (in this case, scholars). Contrariwise, DSEs should be like prêt-à-porter fashion items, affordable for everyone thanks to a reusable infrastructure and a standard, but still customizable, user interface. This approach "can help the spread of digital editions and can provide a more sustainable and durable environment for digital editions" (Pierazzo 2019).

An important approach that is useful to address the issue of sustainability is minimal computing. This is a digital methodology that aims to ensure the long-term sustainability of digital works, facilitating the production of digital humanities works with limited resources, created under a number of constraints.[7] The Humanities Computing and Media Centre and the University Library at the University of Victoria host the "Endings: Concluding, Archiving, and Preserving Digital Projects for Long-Term Usability" project (The Endings Project Team, n.d.), which provides a set of guidelines (Ending Principles) to create sustainable and low-maintenance DSEs through concrete solutions. The Ending Principles are divided into five main components of digital projects – data, documentation, processing, products, and release management. For example, one solution proposed for long-term sustainability is to generate a "static version of each site" (Carlin 2018) instead of preserving only the data.

The third issue is that of fruition, which affects both digital facsimiles and DSEs. In fact, most digitized manuscripts and DSEs are known only to a specialist audience. Moreover, even in the academic environment, printed editions are still easier to cite than digital ones: common standards and protocols for scholarly editing are still lacking, and the advantages of DSEs mentioned above seem to be unclear even to a specialist audience. In particular, for doctoral students and early-career researchers, the easiest way to publish their edition is through self-publishing, which is "completely inappropriate for career-building purposes" (Pierazzo 2019).

3. *The "Digital Resources for Manuscripts" Project*

The main aim of the "Digital Resources for Manuscripts" project is to investigate possible solutions to the problems regarding DSEs described above

[7] See Risam-Gil 2022.

(in particular fruition, but also fragmentation and long-term sustainability). This project arose thanks to the Digital Library of Rome, operates within the national PhD project in Heritage Science, now in its thirty-eighth cycle, is funded by the PNRR, and is coordinated by "Sapienza" University of Rome. To that purpose we plan to use Edition Visualization Technology (EVT) software and to extend its application to case studies that do not belong to an academic environment, so as to widen the audience of DSEs (EVT, n.d.).[8]

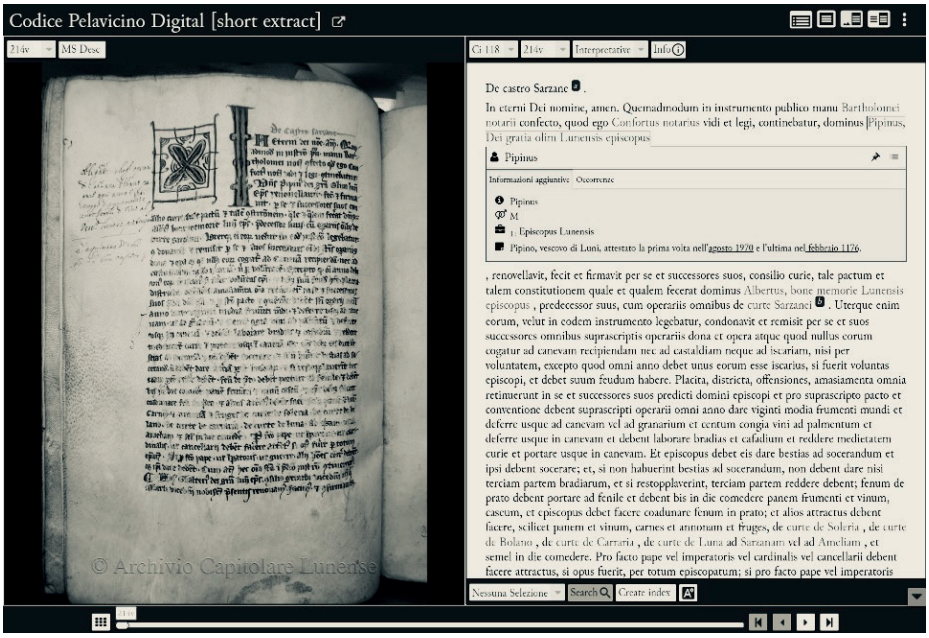
We chose EVT for a number of reasons:

- It is an open source software for the visualization of digital facsimiles, diplomatic and/or interpretative editions (together with a digital facsimile), and critical editions: this allows it to cover most of the possible use cases.
- It creates a DSE starting from an XML-TEI encoded text, thus using the current standard (the Text Encoding Initiative XML-based schemas) for semantic annotation.
- It has many advanced features, such as text-image linking, support for named entities, automatic generation of all witness texts in the collation view, and more.
- It is a user-friendly tool, both for the editor and for the end user, and readily customizable (both via configuration and by applying CSS stylesheets).
- Since it is based on the client-only model, publishing an EVT-based DSE is as easy as copying the EVT folder to a website. For the same reason, and because it is based on standard Web technologies (HTML, CSS, JavaScript), it will require little to no maintenance in the coming years, guaranteeing excellent sustainability.

Thanks to these features, in particular the ability to quickly create prototypes of digital facsimiles accompanied by diplomatic transcriptions, EVT is the perfect tool for the project and an excellent example of the prêt-à-porter model mentioned above. In fact, several projects using EVT can also serve as a model for the creation of DSEs based on documents proposed by the libraries and other cultural institutions we contacted.

[8] See Rosselli Del Turco 2019.

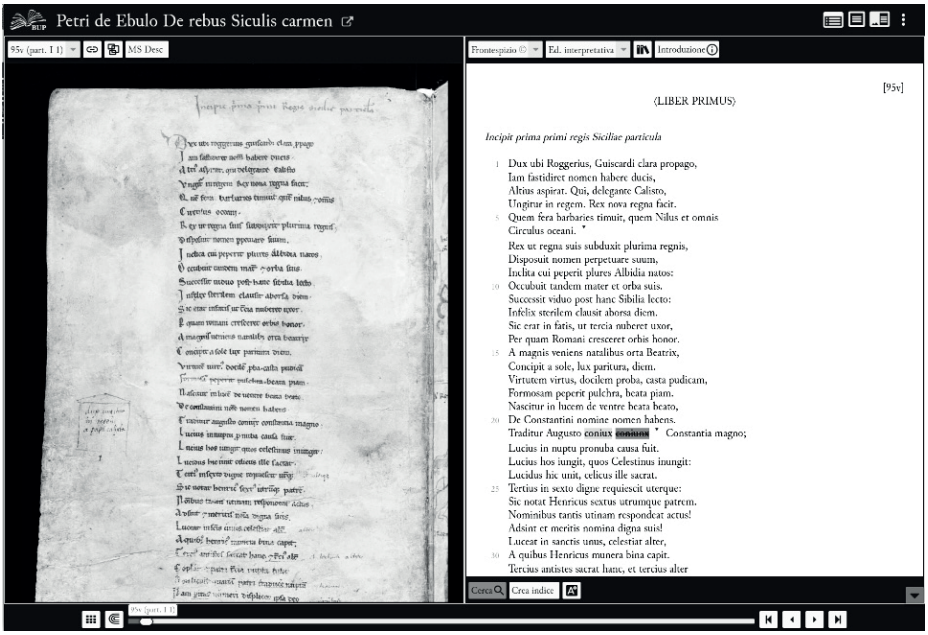
Figure 1. The Codice Pelavicino, digitized



An example of an EVT-based critical and interpretative edition is the digital *De rebus Siculis Carmen* (Delle Donne, 2024), edited by Prof. Fulvio Delle Donne in 2020, which narrates the conquest of the Sicilian kingdom by Emperor Henry VI and is attributed to Pietro da Eboli. There is only one surviving copy, an illuminated manuscript written in Latin between 1194 and 1197, preserved in the Burgerbibliothek in Bern, Switzerland. Selecting the "critical edition" visualization mode allows the user to view the critical apparatus and the sources, while selecting the "interpretative edition" visualization mode brings up a digital facsimile, including image-text linking. There are two lists of named entities: a list of places and a list of people, both linked to their occurrences in the text. It is possible to download the edition in PDF or XML format. A useful example to understand the possibility for the editor to modify the graphical rendering is the edition of the *Storia Fiorentina* by Benedetto Varchi (1721) (Progetto VaSto, n.d.): by selecting the "diplomatic edition" visualization mode, it is possible to visualize the paratext as it appears in the original manuscripts because

the editor added specific style rules within the custom-style.css file in the config folder to create boxes for marginalia.

Figure 2. Pietro da Eboli's *De rebus Siculis carmen* in EVT 2



Like most DSEs, those based on EVT have academics as their main – and often only – users: as already mentioned, our project aims to widen this audience. We are working to propose case studies based on documents provided by public and private institutions in collaboration with the *Digital Library*, the Italian cultural institution responsible for organizing, coordinating and promoting the digitization of cultural heritage at national level. Through discussions with parties interested in using EVT, possible extensions of the software's functionalities are being outlined to adapt it to the needs of a wider audience (e.g., museums, archives, libraries).

The first step was to identify institutions interested in providing case studies. These are currently the Archivio Nazionale in Naples and, in Turin, the Museo Egizio, the Biblioteca Reale, the Archivio Nazionale, and the Officina della Scrittura.

These institutions offered us different kinds of documents as case

studies: for example, the Museo Egizio offered a papyrus, written in Greek, dating from the second century B.C. and coming from the ancient village of Deir el-Medina. The Biblioteca Reale in Turin offered an illuminated manuscript containing a commentary on *In Rhetoricam ad Herennium* written by Ludovico il Moro in 1467. The Officina della Scrittura offered a manuscript diary written around 1930 related to events at the Aurora pen factory. The way in which these DSEs are presented will also vary from one institution to another: some of them will probably be linked to the institution's Web site, while others will be displayed along visitors' routes on monitors or touch-screen tablets with which the visitor will be able to interact. At the time of writing, the edition for the *Biblioteca Reale* of Turin has been completed and handed over to the library. In order not to limit its use to visitors, it will be published on the library's online portal (Musei Reali, n.d.)

An experiment of this kind has already been carried out at the Museo Civico Belliniano in Catania, as part of the "Museo Virtuale della Musica BellinInRete" project.[9] The aim of the project was to create an EVT digital edition based on Bellini's autograph letters, accessible to the general public of the museum, offering the visitor a heterogeneous visit path related both to the music and the philological fields. The letters, encoded according to the TEI Guidelines, and their metadata are displayed in rooms in which Bellini's works are reproduced, creating an immersive experience in which even nonspecialists can appreciate the documents, the life, and the artistic career of the composer.[10] The "Museo Virtuale della Musica BellinInRete" was inaugurated in March 2023.

After a preliminary analysis of the institutions' requests, it seems that the most needed functionality still missing in EVT is the possibility of having a translation of the text next to the transcription. Indeed, this feature seems to be really necessary for editions of texts written in old languages (e.g. Latin, Greek, Old French, Old High German) which are little known to the general public.

3.1. The Role of Our Project within the Italian National Recovery and Resilience Plan

The Italian PNRR – Piano Nazionale di Ripresa e Resilienza (Italian National Recovery and Resilience Plan) (PNRR 2023) – is part of the

[9] Vincenzo Bellini (1801-1835) was an Italian composer who was born in Catania.
[10] Del Grosso et al. 2019.

European program Next Generation EU, a temporary recovery package to help EU member states cope with the economic and social damage caused by the coronavirus pandemic. It was approved by the Italian parliament on April 27, 2021 and sent to the European Commission on April 30, 2021, which finally approved it on June 22, 2021.

The plan has three strategic priorities (digitization and innovation, ecological transition, social inclusion) and sixteen components. The PNRR investments, managed by the Italian Ministry of Culture, are related to Mission 1 (digitization, innovation, competition, culture and tourism), Component 3 (Tourism and Culture 4.0) and are divided into three measures (cultural heritage for the next generation; regeneration of small cultural sites, religious cultural heritage; Cultural and Creative Industries 4.0). Among them, the most relevant for our research is the investment related to the first measure, that is, the digital strategy and platforms for cultural heritage. In fact, the measure aims at creating a national digital infrastructure for the collection and storage of digital resources, the creation of new digital content and services by cultural companies and innovative start-ups, and the digitization of the cultural heritage held in Italian museums, archives, and libraries according to the FAIR principles.[11]

The institution managing the PNRR fund is the Digital Library, the central institute for the digitization of cultural heritage. The managers of the Digital Library have published the National Plan for the Digitization of Cultural Heritage (Digital Library 2022), a plan for organizing the digital transition in the years 2022-2026. The main objectives are the accessibility of digital cultural heritage, the inclusion of new services for users in the digitization strategy, and the interoperability of metadata at international level.

The plan adopts a human-centered approach, emphasizing the importance of creating a positive ecosystem involving all cultural stakeholders. As can be inferred from what has been described above, our project fits perfectly into the objectives of the national plan for digitization as it shares its goals and methods.

Conclusion

In the context of the digital transition currently underway in Italy, the focus is no longer on the process of digitization but on the most effective

[11] Wilkinson, Dumontier, and Aalbersberg 2016.

use of the objects that have already been digitized. While it is true that the audience interested in manuscripts, whether parchment/paper or digital, is mainly a specialized one, it is still possible to find a way to make them more interesting and usable for the general public. One possible solution could be to include DSEs of historical documents in the visitor pathways of museums and archives. Digital editions, thanks to their multimedia form, allow greater interaction with the visitor, who can virtually turn the pages of the manuscripts, consult the translation of the text – if the edition provides one – and learn more about the people, places, or events recorded in the encoded texts.

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