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ATHENA

Technical and policy infrastructure to support persistent identifiers

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¹ OJ L 79, 24.3.2005, p. 1.

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1. Introduction

1.1 The purpose of work package 3

Work package 3 of the ATHENA project (WP3) is tasked with:

1. Reviewing the different standards in use by museums;
2. Facilitating the mapping of those standards to a common metadata standard;
3. Assessing the requirements for the persistent identification of digital objects and collections;
4. Producing tools to support the conversion of museums' data into the common harvesting format for ingestion into the main Europeana service.

WP3 also works together with other work packages in the project. In particular WP3 works closely with WP4 and WP7, feeding information about standards for their work.

1.2 Background to the deliverable

The last deliverable of this work package (D3.4) examined the subject of persistent identifiers (PIDs) for physical objects, digital objects, collections, and organisations. It also reviewed the current use of persistent identifiers in the cultural heritage sector, focusing on the experiences of the participants of the ATHENA project.

Next D3.4 set out ten requirements for the successful implementation of PIDs in the sector. Finally it gave advice and examples of best practise. This deliverable will extend the subject of PIDs into the area of the technical and policy infrastructure needed to support their implementation.

The audience for this deliverable is slightly wider than others in this work package. 'Top management'² in an organisation need:

- To become aware, in general terms, how important identifiers are to the delivery an organisation's information services;
- To see how PIDs can fit into a general policy framework, based of standard code of practice.

1.3 Objects and collections – physical and digital

The 'stars' of a museum's collections are its physical objects, with the obvious exception of 'born digital' material. The purpose of digital objects, together with descriptive metadata, in this environment is to act as surrogates which provide access to the physical. Therefore there is a need to provide a linking mechanism, preferably persistent, between the physical and digital.

For a user to have a meaningful experience it is often necessary to have many surrogates. These can include:

- Different image views of the object, including details, in different 'states' (e.g. open or closed), or X-rays.
- 3D models, reconstructions and replicas (these last two can be physical too).
- Moving images and audios of the object in operation.

To this can be added different metadata for a range of audiences: researchers, members of the public, children, and those speaking a language different from the organisation's native one(s).

² See Section 3 for a definition of this term.

Add to this the likelihood that there will be multiple copies of digital objects then it is obvious that there is a major task that an organisation needs to address if it effectively manages all its materials.

Organisations also manage and give users access, physically and digitally, to objects at the level of the collection rather than that of the individual item. This is done for two reasons:

1. The nature of material. It is practical and economic to manage bulk archaeological and natural science material at this level.
2. As an aid to access to individual items. The story to be told is best done by considering the material together rather than as individual parts.

The important aspect of access to collections for the user is the descriptive metadata associated with the collection. This will allow the user to quickly gain an overview which then could be used to 'drill down' to material at the object level.

Collections, like objects, can be both physical and digital. They also have the same difference in the area of having multiple digital collections for the same physical collection.

There is no standard for how to organise individual items into a collection. Common types of collection are known, based on: field collection site (archaeological and natural science); type of material (e.g. art, decorative art, industrial, and social history); creation period; creation place; and creator. Increasingly users are creating their own 'virtual collections', based on their own purposes and preferences. Also it should be noted that an individual item could be in many collections at the same time.

All these entities: objects and collections – physical and digital; and the links between them need to be managed. PIDs have an important role in doing this. They provide the 'glue' that links the entities together. Therefore it is vital that they are managed and supported by the policy of an organisation.

1.4 Overview of the deliverable

With the needs of top management in mind the deliverable provides sections on:

- Showing the importance of identifiers as keys to cultural information integration;
- Setting PID policy in wider collections management context
- Policy for the management of PIDs
- A brief note on the technical infrastructure needed for PIDs
- Conclusions
- Appendix I: Persistent Identifiers – A Briefing Note [for top managers]
- Appendix II: Survey of mission statements

2. Identifiers – the keys to cultural information integration

*"A museum object is more like an illustration, or witness of the past, than information in its own right. Cultural historical research means understanding 'possible pasts', the facts, events, material, social and psychological influences and motivations. It lives from understanding contexts, by pulling together bits and pieces of related facts from disparate resources, which can typically not be classified under subjects in an obvious way. It lives from taking into account all known facts."*³

In this statement the author, Martin Doer, succinctly describes the case for the integration of cultural information. The Mellon funded ResearchSpace4 project is “aimed at supporting collaborative internet research, information sharing and publication for the cultural heritage scholarly community”. One of the key technologies being used is that of the RDF data model. Here information is broken down into ‘triples’. Each triple links two universal resource identifiers representing ‘real world’ entities.

Another important concept that ResearchSpace uses is that of co-reference. This recognises that the same object⁵ will have been given more than one identifier. This is natural and unavoidable – the same object will have been given a different identifier relevant for that identifier assignment event (e.g. a find number in an archaeological excavation or a sale catalogue).

This means that task for the manager of a set of cultural objects and information is not one of seeking to get universal agreement for identifier for one object. It is rather one of resolution – formally stating that two identifiers are referencing the same object. Systems, based on policy, need to be in place which will allow resolution to take place.

However the first task is to persuade the top management of an organisation that it is worth investing in such a system.

Identifiers in the life cycle of cultural material

This section gives an overview of the important role that multiple identifiers play in the life cycles of cultural heritage objects, their surrogates (e.g. photographs, digital images, and 3-D models). It does not discuss the identifiers for the other cultural entities (e.g. people, places and events) which had a part in the life cycle, but they also have life cycles with similar identifier assignments. The aim is to give scope to information recording tasks that policy may have to address.

Before creation

For some types of material there are other objects which were used in the creation event or describe it. These include:

- Designs, sometimes registered;
- Patents;
- Preparatory materials, e.g. sketches, drawings, models, photographs;

³ Doer, Martin. *Technological Choices of the ResearchSpace Project*. ResearchSpace website. August 2010. See: <https://sites.google.com/site/rSPACEproject/researchspace-concepts/technological-choices-of-the-researchspace-project>

⁴ See: <https://sites.google.com/site/rSPACEproject/>

⁵ We use the word ‘object’ in this section rather than ‘thing’ or ‘work’ or ‘material’.

- Other documentation, e.g. letters, notes about the object;
- Other works that the work might be based, e.g. the statue being painted, the play that the film is an adaption of, an original that this is a copy of).

If this material is known to the organisation is usually included in the ‘history file’. This may be paper-based, but is increasingly in digital format. Surrogates (e.g. copy of a patent) for the material might also appear here too.

If the material is owned by the organisation, or it has a surrogate, then it can be referenced by its own managed identifiers. However some of it will be in the collections of organisations (or private individuals) or in publications. These should have identifiers that will provide access to material. Ideally an organisation’s surrogates will be related to the originals. However an organisation would have to create its own identifiers if they do not have access to the original.

At (or just after) creation

At this time some identifier or part-identifiers will be associated, and in some cases physically marked on the work. Examples include

- Titles;
- Numbers, e.g. print number, edition number;
- Page numbers (in another publication).

It is rare that these are unique, but some are, so they are usually recorded as information (metadata).

After creation, but before acquisition by an organisation

After its creation an object can undergo a series of events which may lead to it being assigned an identifier.

- Being part of a collection;
- Being in an exhibitions;
- Sale catalogues;
- Field collection – find numbers;
- Part of a legal process (e.g. cultural protection);
- Surrogates (e.g. photographs);
- Research;
- Publications;
- Pre-entry procedure;
- Object entry procedure;
- Acquisition procedure.

The last three are part of the process of the object becoming part of the organisation’s collections and it is possible that the ‘final’ identifier will be assigned during them. Earlier identifiers will have a life of their own – being reference, mentioned in publications and other documents from private to public.

Again these identifiers will to be recorded in an organisation’s information system.



After acquisition by an organisation

It is also possible that activities, especially those not being managed by the organisation, will lead to another ‘unofficial’ identifier being assigned. Activities include:

- Exhibition;
- Publication;
- Creating surrogates (including digital);
- Research;
- IPR licensing.

Any new identifiers should be recorded in the metadata of the object.

It can be seen that potentially any object will have many identifiers for it. This situation will have to be managed if an organisation, and perhaps others, is to tell the full ‘story’ of an object. The first step in management is to set up policies to direct it. The next section explores this.

3. Persistent identifier policy in context

Policy for the management of persistent identifiers is part of the overall policy needs of a cultural heritage organisation. It operates within the wider environment of the management of the collection. Here we explore this context.

Collections management is a major activity of any cultural heritage organisation. For it to be successful a cultural heritage organisation must seek to balance between:

- Giving **access** to collections and ensuring the **preservation** of collections;
- The needs of the **collections** and the needs of the **people** who want to use them;
- **Organisational priorities**: ranging from short term, to medium term, to long term.

In order to meet the challenge of balanced collections management, the British Standards Institute developed, with the help and sponsorship of cross-domain set of cultural heritage organisations, a **Publicly Available Specification (PAS 197)** on a Code of practice for cultural collections management⁶. It was published in early 2009, and will be reviewed in a few years with the aim of it forming the basis for national, and possibly international, standard in this area.

The Code aims to:

- Enable an organisation's top management to take a strategic and integrated approach to collections management.
- Provide a blueprint for creating strategies that are sustainable.
- Take into account the legal environment within which an organisation operates.

In order to understand the collections management framework⁷ in the Code of practise it is perhaps best to begin by giving definitions some of terms:

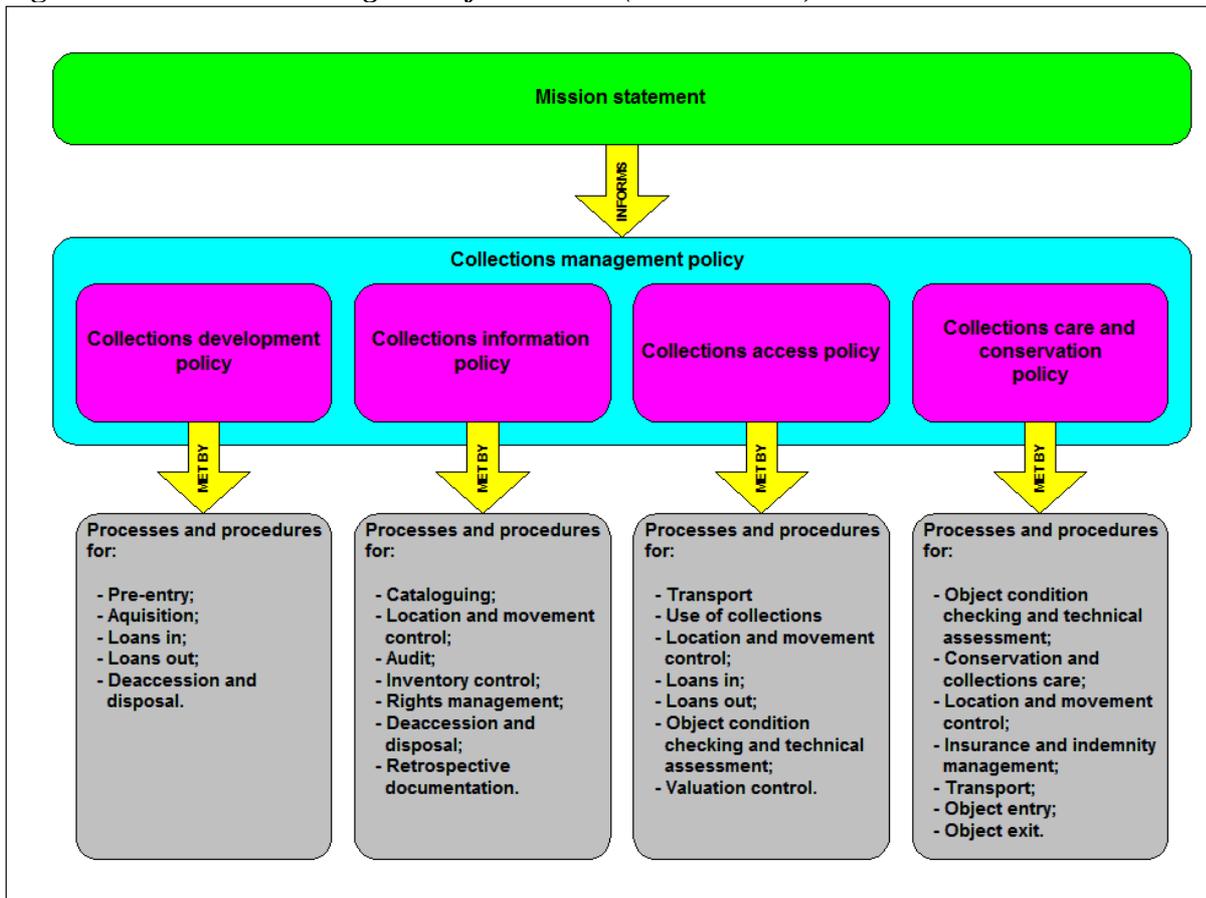
- **Collections management**: The strategies, policies, processes and procedures of an organisation connected with: the development of; information held about; access to; and care of its collections.
- **Top management**: The person or group of persons at the highest level of an organisation who direct and control its activities.
- **Policy**: The overall intentions and direction of an organisation. These are formally expressed, e.g. in a written statement, by its management. It forms the starting point for the setting of objectives and taking actions.
- **Process**: A set of activities which are interrelate or interact with each other, and that have inputs and outputs.
- **Procedure**: The way, documented or not, an activity or process is carried out.

The framework is structured in a hierarchy:

⁶ **British Standards Institute**. 2009. *PAS 197, Code of practice for cultural collections management*.

⁷ The *Code of practice* uses the term 'framework' instead of 'system' in order to avoid confusion with "collections management system" – a computer database used to store information.

Figure 1. Collections management framework (in a museum)



At the top level of the hierarchy is the:

- **Mission statement** – A strategic statement giving a cultural heritage organisation’s fundamental purpose, especially with regard to its collection.

The mission statement informs the different areas of collections management policy which are based on three different strands of activity:

- **Collections information;**
- **Collections development;**
- **Collections access;**
- **Collections care and conservation.**

These policies are met by (implemented) processes and procedures which the organisation uses. These may be based on a standard, like SPECTRUM for museums, but must be documented in the form of a written manual adapted for the organisation.

It should be noted that the creation of the mission statement, policies, processes and procedures is not a one-time process. There must be a commitment to continual review and change of the framework.

4. Policy for the management of persistent identifiers

4.1 Promoting the benefits of persistent identifiers

Implementing and maintaining the use of persistent identifiers (PIDs) in an organisation requires both investment, in time and other resources, and commitment from staff. In order for this to happen the first task that needs to be carried out is the creation of a document that outlines why managing PIDs will benefit the organisation and its users – a ‘business case’.

One way of making a business case is to set out the benefits. Benefits can be both ‘direct’ and ‘indirect’. Direct benefits are those which are a result in doing the activity being considered. Indirect benefits are those which

For PIDs a set of direct and indirect benefits are:

Direct benefits

- Ability to retrieve information, and physical objects, quickly and simply. Everything, both physical and digital, will be associated with an identifier which will point to it or to information about it. Access will be through a central index of some kind.
- Cost-savings in staff time spent handling objects or re-identifying information. Very important at all time, but especially at the time of writing.
- Greater confidence in managing information and objects. Managers will be able to demonstrate that they are managing the organisation according to best practise.
- Improved access to information for all areas of curatorial expertise and other departments. Communications are improved. There are no ‘information silos’ that need mediation to enter.
- Using a standards-based approach will support applications for funded projects (e.g. for the EC). Funders are now demanding that beneficiaries conform to well know standards and best practises. Showing to them that an organisation are using standards will contribute to success

Indirect benefits

- Greater clarity to funders about the extent and content of the organisation’s collections. Using PIDs will ensure that this can be demonstrated.
- Better-managed intellectual property leading to greater opportunities for use and commercial activity. Being able to link, via PIDs, IPR licenses to the works they cover will contribute to efficient management. Better management will also lead to better commercial exploitation.
- Enhanced ability to publish information and to make your collections visible online. Using PIDs that always point to online information will mean that the content will be there 24/7. Some aggregators, e.g. Europeana, will reward this by offering persistent content more prominence.
- Ability to share information through portals: local, regional, national, thematic and international. PIDs form the necessary link to the content online and therefore are the key to open the door to participation.
- Ensuring that information and knowledge is used effectively in the future even if local staff changes. It is always a stressful time, for an organisation, when staff leaves. Always working in a way which ensures that their knowledge is always available to others will reduce that stress. PIDs are a key to that knowledge – pointing to shared information.

One barrier for the organisation to obtaining these benefits is the experience of top management. An organisation may be lucky and top management do appreciate PIDs, but it is highly unlikely. The

subject of will probably be seen as a technical area of an organisation's work. To remove this barrier Appendix I is intended to be a briefing note (sometimes called a 'white paper') aimed at top management. Its aim is to be short (one page) and explain in simple language.

4.2 The role of the mission statement

In order to get an overview of the mission statements that organisations providing content to Europeana through the ATHENA project have a survey of their websites was carried out. This was supplemented by personal communication to key organisations in the project where additional information was thought necessary. It was assumed that given the range in different kinds of organisations represented by the ATHENA project the sample looked at is typical for the cultural heritage sector in general.

In looking at an organisation's website it became obvious that not all had a section called 'Mission Statement'. However it was possible to find 'mission-like' statements embedded in other parts of the website. These were found in sections like "About us", "History of the museum", and "Legal basis". They could also be found in documents accessible through the website like the "Annual Report".

Appendix II shows the results of the survey. Note that some texts have been edited to make the statements for readable.

The lengths of statements vary in size. In one case the 'Mission Statement' of the organisation was a full colour, multi-page, booklet covering the full range of its activities. However most were of a more manageable size consisting of a few sentences, paragraphs or bullet points. At the other extreme a few were just a handful of words.

Looking at the content it is possible to see four 'elements' that make up most of the statements:

- **Collection** – what the organisation has to offer. The types are:
 - Geographic reach (e.g. building, locality, region, nation, continent, worldwide);
 - Temporal range (e.g. middle ages, contemporary);
 - Thematic basis
 - Object (e.g. costume, art, natural science);
 - Human activity (e.g. farming);
 - Event (World War I);
 - Person, people, organisation (e.g. writers, artists, politicians);
 - Subject (e.g. agriculture, music, archaeology, science, history, ethnography, folklore, forest culture, sport, oral tradition).
- **Activities** – *that take place with the collection and with audiences. Examples are:*
 - Be a consultant;
 - Be a guide;
 - Be an intermediary;
 - Carry out research (including implementation, valorisation and conferences);
 - Collect;
 - Digitise;
 - Disseminate information;
 - Document;
 - Educate;
 - Enrich experience;
 - Ensure availability;

- Entertain;
 - Give access;
 - Inform;
 - Interact;
 - Make more approachable;
 - Make understandable;
 - Present;
 - Preserve;
 - Promote;
 - Publish on;
 - Put on exhibitions;
 - Showcase;
 - Stimulate [discussion?];
 - Stimulate cultural tourism (a ministry);
 - Support national identity;
 - Take part in dialogue;
 - Work in partnership (e.g. to contribute to sustainable development).
- ***Audience – Who the collection and activities serve.***
 - [Everyone – by implication];
 - Public;
 - Visitors;
 - Specialists;
 - Researchers;
 - Students (school and university);
 - Age group (especially children).
 - ***Quality – The standard of service provided. This is the least likely element to be in the statement and is usually an aspiration:***
 - Agent of change
 - Be comprehensive;
 - Be devoted;
 - Be influential;
 - Centre of excellence
 - Hub of networking and expertise development;
 - Responsible for [object, sector];
 - Work efficiently;
 - Work in a quality-based manner;
 - World centre;
 - World museum;
 - World's leading museum of [subject area].

Obviously there is no mention of identifiers (persistent or not). Specific mention is at a 'lower level' of policy than the mission statement. However, using an analogy from evolutionary biology, it is possible to see how PIDs could be one of the results of a mandate given from the mission statement.

If a biological entity has a trait which at a later period of time becomes advantageous it is said to be 'pre-adaptive'. For example the opposable thumb of primates was pre-adaptive for the creation and use of tools by human beings. In the same way a mission statement can be pre-adaptive for the

implementation and management of PIDs. Specifically they can be seen as helping to meet the parts of a mission statement that deals with audience, activities and especially quality.

Most audiences are increasingly experiencing collections online. This will be enhanced by using PIDs, allowing links to relevant objects to be seamlessly followed.

Activities where links between objects need to be made, e.g. research, and the online experience, will benefit from PIDs. They are essential where information is shared between organisations and aggregated into services like Europeana.

Using PIDs will make it simple to demonstrate the quality of an organisation's service. PIDs will ensure that there will be no broken links between objects.

Therefore best practise advice is that:

An organisation's mission statement should include elements on audience, activities and quality that give a general environment for the implementation and management of persistent identifiers.

4.3 General collections management policy

The four strands of general collections management activity in PAS 1978 can be defined by what they are related to. These relationships are given below, together with the need for persistent identifiers (PIDs) to support the activities.

Collections information – Activities related to the information about an organisation's collection that an organisation acquires, creates, holds and maintains. It can include:

- Interpretations;
- Stories;
- Results of research.

In this strand PIDs play a vital role. *PAS 1979* defines three areas of policy where PIDS play an important role:

- a) "A description of how the organization obtains, documents, maintains and makes available information about the collection;*
- b) ...*
- c) ...*
- d) A commitment to provide and maintain an information retrieval system; and*
...
- e) A commitment to identify and protect vital records."*

The importance of PIDs in these areas of policy is to be found in use of the words 'maintain[s]', 'makes available' and 'identify'. PIDs enable availability by identifying and linking to an organisation's records and information. When the link is persistent they maintain that link. The *Code of Practise* then goes on to outline what documented procedures need to be in place to meet these policies. They are for:

⁸ *Op cit*, pp15-23.

⁹ *Op cit*, pp18-19.

- a) ...
- b) ...
- c) *Uniquely indentifying all items or groups of items.*
- d) *Recording on the information retrieval system, information about an item or group of items;*
- e) ...
- f) ...
- g) ...
- h) *Identifying, protecting and maintaining access to vital records*
- i) ...
- j) *Publishing information about collections in accordance with the organization's collections access policy ... ”*

These can be can be combined and summarised as best practise advice that:

In order to support implementation and management of persistent identifiers an organisation's collections information policy should include:

- **A description of how it obtains, documents, maintains and makes available information about its collections, including the requirements for persistent identifiers¹⁰.**
- **A commitment to provide and maintain an information retrieval system;**
- **A commitment to identify and protect vital records.**

These polices should be met by procedures that:

- **Uniquely indentify all items or groups of items in its collection;**
- **Record in retrieval system information about an item or group of items;**
- **Identify, protect and maintain access to vital records;**
- **Publish information about items and collections in accordance with its collections access policy.**

The other strands of activity are chiefly concerned with internal management of collections but it is still important to recognise this. The strands are:

Collections development – Activities related to the:

- Collection of new objects and associated materials;
- Researching and reviewing the existing collections;
- Possible removal of items from the collections.

Collections access – Activities related to use of the physical collections and information about them. It covers:

¹⁰ See: **McKenna, Gordon and Wynn, Roxanne**. *Assessment of requirements for persistent identification of objects, collections and institutions*. ATHENA Project. 2010. Access via: <http://www.athenaeurope.org/getFile.php?id=538>

- The right to access;
- The opportunity to access;
- How access takes place.

Collections care and conservation – Activities related to the safeguard of a collection, including:

- Interventive techniques;
- Non-interventive techniques.

These three strands all generate and reference documents, resources, and define links between them and collections they are concerned with. These will need to be identified internally for the management of the organisation's collections. However parts may be published externally and access to them maintained.

Therefore best advice is that:

Organisation's collections development, access, care and conservation policies should include a commitment to identify the documentation that this activity creates, and how it is to manage the persistence of those identifiers.

4.4 Sustaining an information system

In this section we give advice about how the information system¹¹ of an organisation, including its use of persistent identifiers (PIDs), can be sustained. General sustainability is included because it is felt that PIDs need to be seen in the context in which they operate.

Sustainability of information can be defined as:

“The application of guidelines for the management of information that ensures the information resources in an information system remains accessible to users of the system.”

Taken from *SPECTRUM Knowledge*¹² this definition can equally be applied to the sustainability of persistent identifiers (PIDs). The implementation of sustainability is the responsibility of two roles that:

Content provider – Responsible for deciding:

- What should be kept, and identified, by an organisation's information system (its 'resources');
- What metadata should be recorded by the system.

System manager – Responsible for making sure that:

- Resources are in a form accessible to all users of the information system;
- Metadata for resources follows agreed standards, is accurate, and is kept up-to-date;
- The information system respects the copyright of others, for the resources it contains;
- Resources are migrated to new formats, media, and identifiers as required to ensure continuing accessibility.

¹¹ In this section the term 'resource' is used for the documents, metadata and surrogates within an information system as well as the identifiers of physical objects and locations.

¹² Ashby, Helen, McKenna, Gordon and Stiff, Matthew. *SPECTRUM Knowledge*. mda. 2001, p66

It should be noted that these roles may be carried out by more than two people, or may be carried out by the same person, for a particular set of information resources. However it is important that the responsibility for each of these roles is established within an organisation's information system. This may be paper or computer-based or a combination of the two. Some resources may also be only available in non-digital media such as video or microfiche.

Paper-based and other media information systems

Increasingly paper-based and other media systems are becoming less important. However these are still significant in some organisations and in the historical records of others. So the guidance for such systems is included for completeness. Here the tasks which achieve sustainability are those ensuring that:

- The organisation's information system has physical copies of the resources or that it has metadata which allows a resource to be located. Resources are accessed using a register of PIDs. These are internally or externally generated and maintained (e.g. a standard bibliographic reference, ISBN, library reference number, and registered file number).
- Metadata describing the physical location of the resources are accurate and up-to-date. These locations should also have PIDs to enable their easy access.

Changes in the location should be tracked and be the responsibility of the System manager role. Procedures should track when:

- A resource is removed from its normal location;
- The normal location of a resource changes.
- The security and preservation of the information system's resources are implemented following agreed guidelines. These should include:
 - Having back-ups in another medium (for example, on microfilm);
 - Using secure storage (e.g. in a fire-proof safe or off-site);
 - Using archival quality materials for significant information.

Ideally there should be a migration strategy which digitises this system and its resources.

Computer-based information systems

These have become the 'norm' for information systems and may be accessed using in-house networks or, becoming more common, over the Internet, perhaps by web applications. Here the tasks which achieve sustainability are those ensuring that:

- Access to relevant digital resources should be provided by doing **one** of the following:
 - Creating a paper-based version and putting them in the organisation's paper-based system. Doing this may be the best solution to access where computer-based access is not widely available.
 - Storing them in the organisation's computer-based information system. They should be in a standard digital format¹³ to allow the widest access. This may involve transforming them from their original format.

Access to them is provided by storing them on a standalone computer or on a server computer, and accessing over a local area network, intranet or the Internet. The first options would only give limited access. The last two options would use a URL (URI) as

¹³ See: **McKenna, Gordon and De Loof, Chris**. *Recommendations and best practice report regarding the application of standards, including recommendations for a harvesting format and fact sheets for dissemination*. ATHENA Project. 2009. Access via: <http://www.athenaeurope.org/getFile.php?id=538>

the PID and potentially provide the most access.

How storage and access is implemented will depend on the availability of ICT in an organisation, and considerations of IPR.

- If the resource is accessible in another organisation's information system, over the Internet, reference it using a URL (URI) as its PID.
- Metadata describing the location of a resource are accurate and up-to-date. Changes in the location metadata is the responsibility of the System manager role, with procedures in place to:
 - Change the location metadata of digital resources when this takes place (i.e. when they are moved to another computer, change their network address, or URLs).
 - Regularly review the URLs of external resources being accessed over the Internet, and make changes when needed.
- Agreed guidelines for the security and preservation of the information system's resources are implemented. These include having back-up copies of resources and storing them in a secure place (e.g. in fire-proof safe, data safe or off-site). These guidelines should be understood by staff and tested regularly.
- Digital resources are protected against malicious attack by 'hackers', computer viruses and other cyber attacks. Standards methods of protection should be used (e.g. firewalls and anti-virus software).
- Resources are protected against accidental damage by users.
- All staff are aware of their responsibilities in security and the use of resources.

Risk assessment and disaster recovery

The resources of an organisation should be treated in the same way to the physical objects in its collections. All resources must undergo a risk assessment leading to a disaster plan. The disaster plan should include procedures to manage the risk and actions to be taken should the information system be subject to disaster.

4.5 Avoiding persistent identifier duplication

One important aspect of PID management is ensuring that the organisation does not assign multiple PIDs to the same thing – physical or digital objects and collections. The consequence of assigning multiple PIDs to the same thing will be to cause confusion, incorrect links, and partial network of information.

Internally the issue should be:

- Mandated by appropriate policy;
- Managed by the roles identified in the last section;
- Implemented using the instructions in the relevant sections of an organisation's procedural manual;
- Enabled in an organisation's collection's management system (this can paper-based or computer-based). This last requirement will probably be enabled, in a computer-based system, by maintaining a 'registry' of assigned PIDs and not allowing a change of PID without appropriate authority.

All four of these requirements should be in place for this need to be met. There is a danger that if any is missing that the others will not work properly.



Externally, particularly in the online environment of the Internet, the issue of multiple PIDs is mitigated by publishing PIDs, with appropriate descriptive and technical metadata for the things they are identifying. It is important to make clear the thing being identified by the PID. This will avoid confusion between the physical and its digital surrogate(s). Links, using PIDs, from digital surrogates to physical objects, and vice versa, should also be included in the metadata.

The PID systems discussed in D3.4 can manage the external publication of PIDs. Management of PIDs is similar to that internally, with similar management controls and a maintained registry. However organisations may choose not to use them and instead publish PIDs and metadata themselves. One way of doing this would be to publish this information as ‘linked open data’.

5. Technical infrastructure for persistent identifiers

The basic technical infrastructure that is needed for the support of persistent identifiers (PIDs) is that which helps deliver the organisation's policy goals. These have been discussed above in detail, but in summary are:

- **Mission statement** - collection, activities, audience and quality;
- **Collections information** policy;
- **Collections** development **policy**;
- **Collections** access **policy**;
- **Collections care and** conservation **policy**.

The technical infrastructure must also meet the technical requirements set out in the deliverable D3.4.¹⁴ In summary these are:

- **Reliability** – always active and with an updated registry;
- **Authoritativeness** – organisational commitment to the system;
- **Flexibility** – able to handle all types of collection and collection granularity;
- **Interoperability** – using open standards to maximise this.

In overall terms the technical infrastructure for PIDs is in two, interrelated, parts, a:

- **Registry** – a database holding the identifiers and metadata which allows the resolution to human understandable information;
- **Resolution service** – a mechanism which carries out process taking a user to a resources current location, and takes care of errors and broken links.

An example of a solution to these technical infrastructure needs is the, previously discussed (in D3.4), *Handle System*.¹⁵

For aggregators of cultural information, e.g. Europeana, the situation is slightly more complex. This is because they have to resolve PIDs which are in turn resolved by another, unknown to the aggregator, resolution service. This means that there needs to be an additional set of requirements. Work on defining (and implementing) such an infrastructure has formed part of the work of another 'Europeana Group' project, EuropeanaConnect, as the *European Resolution Discovery Service* (ERDS)¹⁶. This is "a meta-resolver that interfaces different resolution services in order to allow identification of an object in the World Wide Web to be independent from the object's actual physical location". Full details can be found in the referenced deliverable but in summary the requirements are that the service must (in part):

¹⁴ See: McKenna, Gordon and Wynn, Roxanne. Op cit. pp22-23.

¹⁵ See: McKenna, Gordon and Wynn, Roxanne. Op cit. p8.

¹⁶ See: German National Library, University of Vienna and Austrian National Library. Europeana Resolution Service. EuropeanaConnect Project. 2010.

Access via:

http://www.europeanaconnect.eu/documents/D5.4.1_eConnect_Europeana_Resolution_Service_v1.0.pdf



- Resolve or redirect to all known standard PIDs and PID resolution services (i.e. URIs (URL/URN), DOI, PURLs, ARKs, OpenURLs, and Handle requests);
- Easily extensible for other types of persistent identifier types;
- Return clear, well defined error codes/messages;
- Handle errors thrown by the local resolvers;
- Offer an easy way to register additional resolvers.

This is an important piece of work, which members of this ATHENA work package were asked to represent the views of museums in, which offers the hope of a ‘universal’ PID system.

6. Conclusions

This deliverable has demonstrated the importance of persistent identifiers (PIDs) in the recording and maintaining of information about cultural heritage. That information is at its most powerful when it is not just facts but it is when those facts are interconnected and synthesised to tell the stories behind the information – a “*witness of the past*”. Those stories begin, potentially, before objects are created, and continue throughout their life cycles and into their life in the custody of the cultural heritage organisation that has responsibility for it.

PIDs play an important role in telling the stories. They provide the:

- Keys that open the doors to the mere facts;
- Links that bind those facts into a web of knowledge;
- Preservation of the links (when they are persistent!).

However identification and persistence are not ‘natural’. They are a result of the activities of cultural heritage practitioners. In organisations work is most successfully carried out when it is: supported by top management, embedded in policy, and implemented in processes and procedures. There is a danger that the first two are missing with serious implications for an organisation. This deliverable has demonstrated how to avoid this situation.

The implementation and management of PIDs have been set within a general, standards based, framework of collections management policy and implementation. At the highest level of policy, the mission statement, PIDs are not specifically mentioned, but support for them can be gained even here through an organisation’s commitment to engage with its audiences, in various activities, and to level of quality of service. PID’s are specifically part of collections management policy and are important in other areas too. Finally these policies are ‘made flesh’ by creating processes and procedures which make PIDs a reality.

With the successful implementation of PIDs in policy and collections management the technical implementation is relatively straightforward. A range of technical solutions is available and were covered in a previous deliverable (D3.4). For an aggregator, particularly Europeana, the technical situation is slightly more complex, but has been solved by another Europeana Group project, EuropeanaConnect – that of resolution of resolvers.

Finally it is hoped by the authors that this deliverable and D3.4 will be useful for organisation starting out on the route of using of PIDs, and will provide a map to those already on the road.

Appendix I Persistent Identifiers – A Briefing Note

The Basics

Although the subject of persistent identification (PIDs) can seem like a technical area of an organisation's work, it is actually straightforward. It is about:

- **Identification** – Using agreed strings of alphanumeric text (identifiers) to provide access, like a key, to information in paper-based, in-house computer, and online systems. They also provide access to physical objects using attached marks or labels.
- **Persistence** – Managing the identifiers in order to maintain the access.

Cultural heritage organisations use persistent identifiers for:

Cultural entity identification

This concerns the persistent identification of physical objects, the information describing those objects (metadata), and their associated cultural entities (e.g. people, places and events).

A physical object and an organisation's own metadata about the object usually have the same identifier. Surrogates for an object (e.g. photographs, digital images, and 3-D models) should have different, but perhaps related identifiers.

Organisations may wish to use the in-house identifiers for access to in-house created information about associated cultural entities. However some of these entities already may have published recognised identifiers (e.g. ISBN for books) which can be used. Organisations may also use the published information too.

Collections management identification

This usually covers the identification of three things:

- **Collection management events** usually associated with physical objects (e.g. acquisition, conservation, movement, IPR licensing, disposal, and exhibition). Surrogates for physical objects will have similar kinds of events associated with them.
- **Display and storage locations** within an organisation. This is used especially for the movement of physical objects, but can also be applied to locations in a computer file system for digital surrogates (e.g. the licensing of a photograph of an object).
- **The organisation itself**. Used to externally identify the organisation.

The Benefits

Implementing and maintaining the use of persistent identifiers in an organisation is a classic change-management process. It requires both investment, in time and other resources, and commitment from staff. The return on this investment, however, can be significant. When constructing a business case consider the:

Direct benefits

- Ability to retrieve information, and physical objects, quickly and simply.
- Cost-savings in staff time spent handling objects or re-identifying information.
- Greater confidence in managing your information and objects.
- Improved access to information for all areas of curatorial expertise and other departments.
- Using a standards-based approach will support applications for funded projects (e.g. for the EC).



Indirect benefits

- Greater clarity to funders about the extent and content of your collections.
- Better-managed intellectual property leading to greater opportunities for use and commercial activity.
- Enhanced ability to publish information and to make your collections visible online.
- Ability to share your information through portals: local, regional, national, thematic and international (e.g. Europeana).
- Ensuring that information and knowledge is used effectively in the future even if local staff changes.

Appendix II Survey of mission statements

This appendix gives the mission statements (or mission like statements), where available, of the organisations who took part in the D3.1 survey.

Belgium

Organisation	Mission statement
ModeMuseum Provincie Antwerpen – MoMu	<i>“Aims to preserve contemporary and historical dress.”</i>
MuHKA (Museum for Contemporary Art Antwerp)	<i>“The stimulation of visual arts and visual culture in the largest sense of the term”</i>
Royal Institute for Cultural Heritage (KIK-IRPA)	<i>“the scientific study and the conservation of the works of art of national heritage”</i>
Royal Museum for Central Africa, Tervuren	<i>“Be a world centre of research and knowledge dissemination on past and present societies and natural environments of Africa, and in particular Central Africa, to foster – among the public at large and the scientific community – understanding of, and interest in this area and, through partnerships, to contribute substantially to its sustainable development. Thus the core endeavours of this Africa-oriented organisation consist of acquiring and managing collections, conducting scientific research, implementing the results of this research, disseminating knowledge, and mounting selected exhibitions of its collections.”</i>
Royal Museums of Art and History	<ul style="list-style-type: none"> • <i>“Collecting and preserving cultural objects with a museological or scientific value in the museums’ domain (Art, Archaeology, Musicology, History, Ethnology, Folklore - collections from all continents)</i> • <i>Keeping of a general inventory, archival information and documentation centre on its collections</i> • <i>Performing scientific research in connection to its collections</i> • <i>Valorisation and diffusion of the results of this scientific research on national and international level</i> • <i>Active participation in scientific projects and conferences on national and international level</i> • <i>Providing information on its collection to the general public and scientific audience</i> • <i>Providing public access to a collection database on museum objects, archival and library information</i> • <i>Providing publications of both scientific a nature and for the more general public”</i>
S.M.A.K.	<i>“Act as a showcase for contemporary trends in the world of art”</i>
Vlaamse Kunstcollectie	<i>“to manage ... heritage in a more sustainable and quality-based manner, and enhance their international reputation. ... to become a hub of networking and expertise development in the cultural heritage sector.”</i>

Cyprus

Organisation	Mission statement
Department of Antiquities	<i>“The management of the archaeological heritage of Cyprus. ... the use of both ancient monuments and archaeological museums for educational purposes and cultural activities, as well as for the stimulation of cultural tourism. ... act as a consultant and as a guide by offering its personnel’s specialised knowledge.”</i>

Estonia

Organisation	Mission statement
Estonian Ministry of Culture	<i>“To support the maintaining of the Estonian national identity by valuing, preserving, developing, acknowledging and spreading Estonian fine arts, cultural heritage and sport in Estonia and abroad supporting both the professional and amateur activities in creativity and sport.”</i>

Finland

Organisation	Mission statement
AAM – Alvar Aalto Museum	<i>“To take care of Alvar Aalto’s material and spiritual heritage and ensure its continuation.”</i>
FNG – Finnish National Gallery	<i>“Enhances the national art collection, organises diverse exhibitions, and brings art to the public. As the central art museum in Finland, it is responsible for the country’s visual arts information assets and the development of the art museum sector.”</i>
KMCH – Kuopio Museum of Cultural History	<i>“To present the city of Kuopio and the North Savo prehistory, history, folk life and other cultural history of the region and to promote our material and built cultural preservation.”</i>
LCM – Lahti City Museum	<i>“To collect, document, research, exhibit and publish historical, cultural-historical and ethnological material and oral tradition in its own area” [Lahti Historical Museum]</i>
Lusto the Finnish Forest Museum	<i>“Focusing on Finnish forest culture and illustrating the interaction between man and the forest from the past to the future.”</i>
NA – National Archives of Finland	<i>“To ensure that records belonging to the national cultural heritage are preserved and to promote research based on them.”</i>
NBA – National Board of Antiquities	<i>“Preserves Finland’s material cultural heritage: collects, studies and distributes knowledge of it.”</i>
Sarka, the Finnish Museum of Agriculture	<i>“The preservation of the material cultural heritage of Finland by maintaining a museum with the subject matters of mechanized agriculture, animal husbandry and research activities according to the general museum principles.”</i>
TM – Tampere Museums	<i>“To make art more approachable; a natural part of life.” [Art Museum]</i>
UH.HUL – National Library of Finland, National Digitisation Centre	<i>“Ensures the availability of the published national heritage in the community.”</i>

France

Organisation	Mission statement
Ministry of Culture and Communication (MCC)	<i>“Defines, coordinates and evaluates the state policy on architecture, archives, museums, monuments and archaeological sites.”</i>

Germany

Organisation	Mission statement
Badisches Landesmuseum Karlsruhe (BLMK)	<i>“For cultural, art and regional history in the Baden region of Baden-Württemberg... a universal museum in which history, art and everyday life throughout the ages are brought together to provide a comprehensive cultural historical synopsis.”</i>
Landesmuseum Württemberg Stuttgart (LMWS)	<i>“Makes technical developments understandable in ever more complex a world and illustrates their influence on the conditions of work and life of humans.”</i>
Lindenmuseum Stuttgart (LMS) Inventar der Kunsterwerbungen (MWK)	<ol style="list-style-type: none"> 1. <i>“We are a museum of world cultures. We believe that all cultures have equal value.</i> 2. <i>Our area of interest encompasses the human cultural memory.</i> 3. <i>Our collections challenge and motivate us.</i> 4. <i>We present the diversity of human cultures and facilitate direct emotional and intellectual encounters with the original objects in our collections.</i> 5. <i>We make visitors aware of cultural processes occurring in the past, in the present, and in the future.</i> 6. <i>We provide a forum for dialogue between people of different cultures.</i> 7. <i>Our visitors are the life of our museum. We strive to make it attractive to them.</i> 8. <i>We are an active partner in both world-wide and local networks.</i> 9. <i>We are a team and we achieve our goals as a team.</i> 10. <i>We continue to develop as a museum.”</i>
Staatliche Kunsthalle Karlsruhe (SKK)	<i>“Understands itself as an intermediary between the past, present and future. The focus is not only the preservation of the legacy of several centuries, but also the current dialogue with the historical collection and its high quality enlargement.”</i>
Staatliches Museum für Naturkunde Karlsruhe (SMNK)	<i>“Life is diversity and change”</i>
Staatsgalerie Stuttgart (SGS)	<i>“To enrich your experience of our collection and special exhibitions through informative, entertaining, and interactive programs.”</i> [education department]

Greece

Organisation	Mission statement
Epigraphical Museum	<i>“To safeguard, protect, conserve, display and promote the epigraphical collections that it contains.”</i>
Historical Archive of the Aegean “Ergani”	<i>“To collect, document, digitise, research and exhibit archive material related to the economic, social political and cultural history of the North East Aegean during the 19th and 20th centuries.”</i>
Museum of Cycladic Art	<i>“Dedicated to the study and promotion of ancient cultures of the Aegean and Cyprus, with special emphasis on Cycladic Art of the 3rd millennium BC.”</i>
National Archaeological Museum of the Hellenic Ministry of Culture	<i>“To house and protect antiquities from all over Greece, thus displaying their historical, cultural and artistic value.”</i>
National Hellenic Research Foundation	<i>“The organisation, finance and support of high-level research projects in the humanities and the natural sciences.”</i>
National Museum of Contemporary Art	<i>“To offer all the Museum's visitors, which remains an unreservedly democratic organisation, the "other" dimension which in our time cannot be conceived outside transcultural and ecumenical patterns.”</i>
Piraeus Bank Group Cultural Foundation	<i>“Organizes and manages a network of thematic museums, which study, preserve and promote Greece's heritage and cultural identity.”</i>
STUDIO-parallel circuit	<i>“to make Greek and international feature films of special cultural value available to the broadest possible audiences of Greeks and Greeks living abroad”</i>

Hungary

Organisation	Mission statement
Hungarian Radio	<i>“Provide public service broadcasting and to protect [Hungarian] independence”</i>
Museum of Literature Petőfi (PIM)	<i>“Collecting and preserving records of Hungarian literature.”</i>

Israel

Organisation	Mission statement
Israel State Archive	<i>“Gathering the archival records (of all types) of state organisations, keeping them for posterity, and making them available to the public in accordance with viewing regulations.”</i>
The Israel Museum	<ul style="list-style-type: none"> • <i>“To be the leading cultural institution in Israel, one that will constitute an unparalleled focal point of attraction and make its mark on Israeli society by preserving unique original objects of material culture, analyzing them, and displaying them in a stimulating fashion;</i> • <i>To offer visitors a direct experience with original object from material cultures throughout the world and the ages, while satisfying both the senses and the intellect.</i> • <i>To preserve and advance the material culture of Israel, in collaboration with the museum's shareholders, the government of the state and the state's professional community of colleagues, artists, and institutions;</i> • <i>To cultivate the resources of the museum's staff and of its donors, and to develop their capability, and their commitment to the museum.”</i>
National Library of Israel	<i>“To collect, preserve, cultivate and endow the treasures of knowledge, heritage and culture in general, with an emphasis on the Land of Israel, the State of Israel and the Jewish people in particular.”</i>

Italy

Organisation	Mission statement
Accademia nazionale di Santa Cecilia (St. Cecilia National Academy)	<i>“Promoting the culture and heritage of music ... to become a centre of excellence for outstanding musical education.”</i>
Querini Stampalia Foundation	<i>“Promote the cult of good studies and relevant disciplines.”</i>
Soprintendenza per il Polo museale fiorentino (Superintendency to the Museums Pole in Florence)	<i>“Responsible for the protection of the artistic, historic and ethno-anthropological heritage belonging to others within the “territory” of the city of Florence.”</i>
Soprintendenza Speciale per I Beni Archeologici di Napoli e Pompei (Special Superintendency for the Napoli and Pompei Archaeological Heritage)	<i>“Protection of a wide territory.”</i>
Superintendency to the National Gallery of Modern and Contemporary art – GNAM	<i>“To represent “living” art.”</i>

Latvia

Organisation	Mission statement
Valsts Aģentūra "Kultūras informācijas sistēmas" (State agency “Culture Information Systems”)	<i>“To help memory organisations - archives, libraries and museums to preserve and make accessible cultural heritage for future generations, using advanced information technology solutions.”</i>

Poland

Organisation	Mission statement
International Centre for Information Management Systems and Services	<ul style="list-style-type: none"> • <i>“To be a centre of excellence for the region in the preparation and delivery of educational courses and professional development for those involved in the management of cultural organisations namely libraries, archives, and museums. Particular attention is to be devoted to the impact of the Internet and electronic publication on these organisations.</i> • <i>To serve practitioners in the critical efforts involving the creation and maintenance of digital libraries, archives or museums, managing and costing distributed information services, and utilising online reference and information resources;</i> • <i>To advance the level of professionalism for practitioners, teachers, and post-graduate students interested in these new unfolding fields;</i> • <i>To conduct research in the area of library and information science, especially its effects on organisations of higher education and society in general;</i> • <i>To be an agent of change and an influence towards growth in the emerging free market democracies of Central and Eastern Europe.”</i>

Romania

Organisation	Mission statement
CIMEC – Institute for Cultural Memory	<i>“To investigate, develop and make use of the information and communication technology in the field of cultural heritage.”</i>

Slovenia

Organisation	Mission statement
Archives of the Republic of Slovenia	<i>“To collect, preserve, arrange, describe and facilitate access to the national archival heritage of the Republic of Slovenia”</i>
Slovene Ethnographic Museum	<i>“To give present and future generations an insight into the traditional and contemporary culture of Slovenes living on the territory of Slovenia and in nearby countries and of Slovene immigrants and ethnic groups living in Slovenia. It also aims to foster knowledge about non-European cultures.”</i>
Technical Museum of Slovenia	<i>“To collect, preserve, protect and exhibit moveable elements of heritage pertinent to and symbolic of the historical development of this nation’s indigenous crafts, trades and industry.”</i>
Slovenian Museum of Natural History	<i>“Protects, studies, and communicates the material and non-material heritage of natural origin as well as biodiversity.”</i> □
National Museum of Slovenia	<i>“Collect, document, preserve, and investigate the mobile cultural heritage of Slovenia and present it to the public.”</i>
Charintium Regional Museum	<i>“Established [as] the district museum ... transformed into a general regional museum ... cover archaeological, ethnological and historical sphere together with educational and renovational activities. We are also engaged in general research work on the earlier epochs in Carinthia and on the ways of life in this part of Slovenia. ... we are meeting as many and as broad requirements and interests of our large audience as possible. Additionally, we have always been ready to offer our technical help by advising the public and private collections.”</i>

Sweden

Organisation	Mission statement
Riksarkivet (National Archives of Sweden) and Krigsarkivet (The Military Archives)	<i>“To provide the public with the means of accessing public records, to secure information for judicial and administrative purposes, and to provide documentation for purposes of research.”</i>
Stockholm County Museum (Stockholms läns Museum)	<i>“To preserve the city's cultural heritage, bring it to life and convey it to Stockholm residents, visitors and future generations.”</i>

United Kingdom

Organisation	Mission statement
Collections Trust	<i>“To improve the quality of life by ensuring that cultural collections are available for use and enjoyment by everyone, now and for the future.”</i>
English Heritage	<ul style="list-style-type: none"> • <i>“Help people develop their understanding of the historic environment;</i> • <i>Get the historic environment on other people’s agendas;</i> • <i>Enable and promote sustainable change to England’s historic environment;</i> • <i>Help local communities to care for their historic environment;</i> • <i>Stimulate and harness enthusiasm for England’s historic environment;</i> • <i>Make the most effective use of the assets in our care.”</i>
Fitzwilliam Museum [Cambridge]	<i>“To contribute to society through the pursuit of education, learning, and research at the highest international levels of excellence.”</i>
Royal Albert Memorial Museum and Art Gallery [Exeter]	<p><i>“Document the momentous changes that Devon and Exeter have undergone from geological times to the present... [be] one of Britain’s finest regional museums. ... cares for a wonderful and diverse collection consisting of over one million individual objects and specimens from all over the globe ... of local, national and international importance, and many ... of outstanding historical or cultural significance.</i></p> <p><i>Do more than represent its collections. ... stimulate thoughts and ideas, seek opinions, start conversations and encourage debate. ... open, collaborative and inclusive with different voices, personal interpretations and new perspectives. ... using its collections flexibly to explore meaning, ethics and concepts from small ideas to global issues”</i></p>
Victoria and Albert Museum [London]	<p><i>“Enriches people’s lives by promoting the practice of design and increasing knowledge, understanding and enjoyment of the designed world.</i></p> <p><i>The Museum’s key strategic objectives are:</i></p> <ul style="list-style-type: none"> • <i>Access and Audiences: To provide optimum access to collections and services for diverse audiences, now and in the future</i> • <i>National and International: To be acknowledged and respected as the world’s leading museum of art and design</i> • <i>Creative Design: To promote, support and develop the UK creative economy by inspiring designers and makers, and by stimulating enjoyment and appreciation of design</i> • <i>Efficiency and Effectiveness: To operate with financial and organisational efficiency”</i>
Wiltshire Archaeological and Natural History Society (WANHS) [Devizes]	<i>“To educate the public by promoting, fostering interest in, exploration, research and publication on the archaeology, art, history and natural history of Wiltshire for the public benefit.”</i>