

# DiSSCo related output

This template collects the required metadata to reference the official Deliverables and Milestones of DiSSCo-related projects. More information on the mandatory and conditionally mandatory fields can be found in the supporting document 'Metadata for DiSSCo Knowledge base' that is shared among work package leads, and in Teamwork > Files. A short explanatory text is given for all metadata fields, thus allowing easy entry of the required information. If there are any questions, please contact us at info@dissco.eu.

## Title

DiSSCo Training Strategy

## Author(s)

Sofoklis Soitirou, Ana Casino, Marko Lovric

## Identifier of the author(s)

0000-0001-8909-5963; 0000-0002-9869-6573;  
0000-0002-9017-1684

## Affiliation

CETAF

## Contributors

Judite Alves (ULISBOA), Hugo de Boer (NHM UoO),  
Lorenzo Cecchi (UniFI), Magalie Castelin (MNHN),  
Helen Hardy (NHM), Vanni Moggi (UniFI),  
Bruno Ribeiro (ULISBOA).

## Publisher

CETAF

## Identifier of the publisher

0058ctf29

## Resource ID

## Publication year

2022

## Related identifiers

## Is it the first time you submit this outcome?

Yes

## Creation date

15/12/2022

## Version

## Citation

Sotiriou, S (et al.), 2022. Deliverable D2.1 "DiSSCo Training Strategy"

## Abstract

Deliverable D2.1 describes the Training Strategy for the DiSSCo Research Infrastructure. Such an innovative infrastructure that introduces numerous innovative methods and tools for the NHC organisations needs a well-designed training service and users support mechanism in place. In this framework the DiSSCo Training Strategy is based initially on personnel capacity building aiming both at the side of the data suppliers (collection managers, data digitizers, museum technicians, etc.) and the side of the users of DiSSCo (researchers, policy makers, students, environmental Agencies, NGOs, etc.). The DiSSCo Training Strategy is the outcome of the work under the related Task` 2.1. The work carried out builds upon a) information gathered in previously and currently running projects, b) new information collected in Task 3.1 (Improve digital skills and competencies across DiSSCo facilities) and c) current trends related to the Digital Action Plan of the EU, to develop a training strategy with distinct channels and modes of accessing training to address the identified needs.

**Content keywords**

other

**Other content keywords**

Competence-based Approach, Capacity Building in NHC Organisations, Train the Trainer Approach, Professional Development and User-centered Design

**Project reference**

DiSSCo Prepare (GA-871043)

**WP number**

WP2

**Project output**

Deliverable

**Deliverable/milestone number**

D2.1

**Dissemination level**

Public

**Rights****License**

CC0 1.0 Universal (CC0 1.0)

**Resource type**

Text

**Format**

PDF

**Funding Programme**

H2020-INFRADEV-2019-2

**Contact email**

marko.lovric@cetaf.org



## DiSSCo Prepare WP 2 – D2.1 DiSSCo Training Strategy

Task Leader: CETAF



Authors: Sofoklis Soitirou (CETAF), Ana Casino (CETAF), Marko Lovric (CETAF)

Contributors: Judite Alves (ULISBOA), Hugo de Boer (NHM UoO), Lorenzo Cecchi (UniFI), Magalie Castelin (MNHN), Helen Hardy (NHM), Vanni Moggi (UniFI), Bruno Ribeiro (ULISBOA)



## Abstract

Deliverable D2.1 describes the Training Strategy for the DiSSCo Research Infrastructure. Such an innovative infrastructure that introduces numerous innovative methods and tools for the NHC organisations needs a well-designed training service and users support mechanism in place. In this framework the DiSSCo Training Strategy is based initially on personnel capacity building aiming both at the side of the **data suppliers** (collection managers, data digitizers, museum technicians, etc.) and the side of the **users of DiSSCo** (researchers, policy makers, students, environmental Agencies, NGOs, etc.). The DiSSCo Training Strategy is the outcome of the work under the related Task` 2.1. The work carried out builds upon a) information gathered in previously and currently running projects, b) new information collected in Task 3.1 (Improve digital skills and competencies across DiSSCo facilities) and c) current trends related to the Digital Action Plan of the EU, to develop a training strategy with distinct channels and modes of accessing training to address the identified needs.

## Contribution to DiSSCo RI (FOR DELIVERABLES ONLY)

D2.1 DiSSCo Training Strategy as part of WP2: Human Resources, Training & Users Support, contributes to Scientific Readiness objectives d, e & f

## Keywords

Competence-based Approach, Capacity Building in NHC Organisations, Train the Trainer Approach, Professional Development and User-centered Design

# Index

Abstract .....	2
Keywords .....	2
Index .....	3
00 ABSTRACT .....	7
01 INTRODUCTION .....	8
DiSSCo Portfolio of Services .....	8
DiSSCo Training Strategy .....	9
Structure of the Deliverable .....	10
02 CONCEPTUAL FRAMEWORK .....	12
Cultural Change and Digital Transformation .....	12
Key Focus Areas for the Digital Transformation of the Organization .....	12
Landscape Analysis of Best Practices for Training Delivery.....	14
SYNTHESYS+ Catalogue and Recommendations .....	16
Capitalizing on the experiences of DEST .....	17
Lessons Learnt from BIOTALENT Online Course .....	19
ICEDIG: Active Involvement of Citizens in the mass digitization process.....	20
03 TRAINING AS PART OF THE DIGITAL STRATEGY OF THE ORGANIZATION .....	22
Introduction.....	22
Factors affecting the development of a digital strategy of the organization.....	22
Opportunities for small museums.....	24
Skills and profiles that facilitate the digital transformation of the organisation .....	24
04 TRAINING NEEDS, CAPACITY BUILDING AND RECOMMENDATIONS.....	27
Introduction.....	27
Methodology .....	28
Survey results compilation and analysis .....	29
Overall analysis of the survey results .....	29
Key Findings.....	32
Proposed recommended actions .....	33
General Considerations .....	33
Specific Recommendations focused on the DiSSCo targeted dimension .....	34
05 IDENTIFICATION OF TRAINING PROVIDERS, PLATFORMS AND DELIVERY CHANNELS .....	37

Introduction.....	37
eLearning platforms available .....	37
What is an eLearning platform.....	37
Scope for prioritisation.....	38
Training based on the Online classroom experience .....	38
Selected eLearning platforms available .....	39
Moodle .....	39
Chamilo.....	41
Customer experience .....	43
Gamification .....	43
Adaptability .....	44
Final remarks and suggested actions .....	44
Training based on MOOC-type course building & delivery .....	45
Key Components of Open edX .....	45
Learning Management System (LMS) .....	45
Front End .....	46
Course Browsing.....	46
Course Structure.....	46
Studio .....	46
Discussions .....	47
Mobile Apps .....	47
Analytics .....	47
<b>06    SETTING UP THE DiSSCo TRAINING STRATEGY .....</b>	<b>48</b>
Introduction.....	48
Training Approach and Users Guidance .....	50
Assisting behavioral change: Training Participants as Change Agents in their Organizations.....	50
Understanding the Train the Trainers Model.....	51
Overall Goals of the Train the Trainers Model.....	51
Specific Objectives.....	51
TtT Components .....	51
Community Building and Support Mechanism .....	52
Engagement.....	53
Visionary Workshops.....	55
Practice Reflection Workshops .....	55
Summative Workshops .....	56

Professional development opportunities.....	56
Support and Communication Strategies .....	57
Certification.....	57
Community of Devoted DiSSCo Users .....	58
An example of a DiSSCo Training Course .....	58
DiSSCo Training Assessment Portfolio.....	63
<b>07 DEVELOPING LOCALIZED CASE STUDIES FOR THE PARTICIPATING ORGANIZATIONS .....</b>	<b>64</b>
Introduction.....	64
Indicative case study .....	65
Template for the Landscape Analysis.....	67
Initial Analysis of the Partners Training Needs and Prioritization.....	67
User Communities Expectations .....	68
Change Culture .....	69
Training on Innovative tools for automating digitization.....	69
Expansion of the digitization workforce through Citizen Science.....	70
Training Design and Optimization of the Training Strategy .....	70
Focus Areas of the DiSSCo Training Strategy .....	70
Profile of the Staff .....	71
Training Priorities .....	72
Training Content.....	73
Delivery Channels and Duration of the Activities.....	73
<b>08 RECOMMENDATIONS FOR THE NEXT STEPS .....</b>	<b>74</b>
The DiSSCo Training Service: Developing a framework for the DiSSCo Training Offer .....	74
Organisation .....	74
Development and Financial Support .....	75
Dissemination .....	78
Certification .....	79
Initial Risk Assessment and Mitigation Plans .....	79
<b>09 ANNEX 1: SURVEY MASTER DOCUMENT .....</b>	<b>82</b>
<b>10 ANNEX 2: IRL CATEGORIES AND SUBCATEGORIES .....</b>	<b>90</b>
<b>11 ANNEX 3: TEMPLATE FOR THE LANDSCAPE ANALYSIS .....</b>	<b>92</b>
<b>12 ANNEX 4: NHM-UIO CONTRIBUTION .....</b>	<b>94</b>
<b>13 ANNEX 5: NHM LONDON CONTRIBUTION .....</b>	<b>96</b>
<b>14 ANNEX 6: IT-UNIFI-MSN CONTRIBUTION .....</b>	<b>99</b>
<b>15 ANNEX 7: MNHN CONTRIBUTION .....</b>	<b>103</b>





---

## 00 ABSTRACT

Deliverable D2.1 describes the Training Strategy for the DiSSCo Research Infrastructure. Such an innovative infrastructure that introduces numerous innovative methods and tools for the NHC organisations needs a well-designed training service and users support mechanism in place. In this framework the DiSSCo Training Strategy is based initially on personnel capacity building aiming both at the side of the **data suppliers** (collection managers, data digitizers, museum technicians, etc.) and the side of the **users of DiSSCo** (researchers, policy makers, students, environmental Agencies, NGOs, etc.). The DiSSCo Training Strategy is the outcome of the work under the related Task` 2.1. The work carried out builds upon a) information gathered in previously and currently running projects, b) new information collected in Task 3.1 (Improve digital skills and competencies across DiSSCo facilities) and c) current trends related to the Digital Action Plan of the EU, to develop a training strategy with distinct channels and modes of accessing training to address the identified needs.

## DiSSCo Portfolio of Services

Natural Science Collections (NSCs), which exist in all the world's countries, are some of the longest established and most mature Research Infrastructures (RI). The scientific need for access to the information derived from the study of those objects has been so big that today we can find publicly accessible scientific collections in more than 500 distinct physical locations across Europe. These collections include large institutions such as the Natural History Museum in London and the Muséum national d'Histoire Naturelle in Paris, both established in the 18th century, as well as many medium and smaller sized museums, universities, botanical gardens, and research centers, with their associated biological and geological collections and research expertise. Together, European collections hold approximately 1.5 billion ( $1.5 \times 10^9$ ) specimens, accounting for more than 55% of the world's natural science collections. These assets are currently scientifically curated and studied by over 5,000 in-house scientific employees.

In 2018, NSCs entered the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) as DiSSCo - the Distributed System of Scientific Collections. With this, European NSCs reached a tipping point, committing to transforming a fragmented landscape of crucial scientific resources into an integrated, seamless collection providing unified access services to a diverse user base.

The inclusion of DiSSCo in the ESFRI Roadmap followed a series of joint undertakings that improved the ability of the European NSCs to align institutional policies and practices, develop common solutions, and plan collective strategic goals for the future. During the design (2004-2014) and proposal (2014-2016) phases of DiSSCo, the consortium has taken specific actions towards a more robust collaboration framework. Together, NSCs studied the optimal ways through which they can join forces and evaluated the feasibility of their joint endeavors, from a scientific, financial, organisational, and technical perspective. The DiSSCo RI works for the digital unification of all European natural science assets under common curation and access policies and practices that aim to make the data easily Findable, more Accessible, Interoperable and Reusable (FAIR).

DiSSCo will deploy a comprehensive portfolio of services across three main categories: a) e-Science Services, b) Physical and Remote Access Services and c) Support and Training Services.

**e-Science services:** A one-stop-shop for services providing discovery, access, interpretation, and analysis of complex linked data. All eservices will be provided as part of the European Open Science Cloud (EOSC) public offering.

**Physical and remote access services:** Universal, harmonized physical access and digitization-on-demand services. Physical access is up till today still the main mechanism through which scientists interact with NSCs, but as the digital knowledge base grows, the balance will shift. DiSSCo will continue supporting physical access, balancing requests for physical access with for example digitization-on-demand or generating new data (e.g., DNA sequences, 3-D or microscopic imaging) that can be linked to the digital specimen objects across the participating DiSSCo facilities. A suite of e-services will support the process of access provision from both the user and the provider (facility) side.

**Support & training services:** This service pillar focuses on a) providing a comprehensive user support system for all DiSSCo services and b) enabling more users to embark on data-intensive science research in bio- and geo-diversity. This will be achieved by improving digital skills and competencies across the user audiences and supporting career paths for new roles (e.g., digital curators) in the distributed facilities (NSCs).

## DiSSCo Training Strategy

The current Deliverable D2.1 Training Strategy is the outcome of the work under the related Task 2.1. The work carried out builds upon a) information gathered in previously and currently running projects (SYNTHESYS+ <http://synthesys.info> and MOBILISE Action <http://mobilise-action.eu>), b) new information collected in Task 3.1 (Improve digital skills and competencies across DiSSCo facilities)<sup>1</sup> and c) current trends related to the Digital Action Plan of the EU, to develop a training strategy with distinct channels and modes of accessing training to address the identified needs. Personnel capacity building considers both the side of the **data suppliers** (collection managers, data digitizers, museum technicians, etc.) and the side of the **users of DiSSCo** (researchers, policy makers, students, environmental Agencies, NGOs, etc.).

The work includes a review of existing best practices for training delivery and creation of materials (including user-generated content approaches), and organizational structures to support it. The training scheme refines and complements:

- existing training programmes and activities for professionals organized within the DiSSCo community in the framework of the abovementioned projects,
- CETAF DEST (Distributed School of Taxonomy <https://cetaf.org/explore/dest-distributed-school-of-european-taxonomy/>) that transfers knowledge between current and future generations of taxonomists by providing high quality education and prepares students for future taxonomic careers, and
- BIOTALENT EC-funded project (<https://biotalent.myspecies.info/>), that is offering a course for the development of knowledge, skills and competences of science educators, nature guides and for citizens interested in biodiversity,

considering both academic and continuous professional training as well as creating opportunities for the active involvement of citizens.

Additionally in the framework of the work that was realized in this task, the recommendations produced by the DiSSCo Design Project ICEDIG (<http://icedig.eu>) were further developed towards elaborated paths to integrate bioinformatics-related topics into formal education, while formalizing collaborative actions with e.g., academia, professional associations and providers of vocational training.

The Training Strategy has been developed on the ‘train the trainer’ principle, creating a strong network of trainers, able to provide support to their local (institutional and national) communities. Additionally, diversity based on aspects such as educational

---

<sup>1</sup> Hardy, H., Koivunen, A., Groom, Q., Mergen, P., Berger, F., von Mering, S., Giere, P., Figueira, R., Arsénio, P., & Cartaxana, A. (2021). DiSSCo Prepare Deliverable D3.1 "Summary Insights and Recommendations on DiSSCo Competencies and Digital Maturity". DiSSCo Prepare. <https://doi.org/10.34960/3pc3-pp32>

resources, cultural differences and policies and regulations applicable have been considered to ensure the continuation and the sustainability of the proposed strategy.

## Structure of the Deliverable

The process that was adopted included specific activities, described in detail in the chapters of this report:

Chapter 2 describes the conceptual framework of the DiSSCo Training Strategy. It highlights the contribution of the cultural change aspect that is necessary for sustainable innovations and organizational change. The introduction of innovative approaches and tools, like DiSSCo, requires fundamental changes in the organization and its staff culture, rather than simply introducing or changing isolated practices. To successfully drive change, ICT-supported innovations must be flexible, responsive to the specific organization needs, embedded in the organization context and open to its environments. The chapter provides a list of key factors that are important for the organization to embark on the digital transformation journey. It also describes the expected contributions of previous projects that have delivered the preparatory work for the design and development of the DiSSCo Training Strategy.

Chapter 3 describes how the proposed training scheme could be integrated into the overall digital strategy of the organization. It describes a holistic approach that is crucial for the development of an effective development plan that brings together all the involved stakeholders. It highlights the factors that are crucial for the development of the digital strategy, describes the opportunities that a major infrastructure like DiSSCo offers to small NHCs and offers an overview of the key skills and profiles that could contribute to the development of the digital strategy of the organization.

Chapter 4 focuses on the compilation of needs for skills/competencies. The compilation of needs for skills/competencies represents one of the main building blocks for the development of the DiSSCo training strategy that responds to the needs of the DiSSCo research infrastructure.

Chapter 5 describes the work done in relation to the identification of training providers/platforms. The identification of training providers/platforms provides the second major building block of the DiSSCo training strategy, focusing on the best channels for delivering the know-how and facilitating knowledge transfer to the various target audiences (data suppliers and users). The aim is to develop a framework that identifies the components and the structure supporting the delivery of training to meet the detected needs. The envisaged capacity building activities to carry out in support to DiSSCo Research Infrastructure (RI) will cover both the side of the data suppliers (collection managers, data digitizers, museum technicians, etc.) and the data users of DiSSCo (researchers, policy makers, students, environmental Agencies, NGOs, etc.).

Chapter 6 describes the proposed DiSSCo Training Strategy. It highlights the course characteristics and Support Materials Specifications. Furthermore, it provides guidelines for effective community building and the development of a sustainable Support Mechanism necessary to facilitate the training delivery.

Chapter 7 describes the outcomes of an initial participatory exercise to test the adaptability of the proposed training strategy to the local settings of the participating

organisations. DiSSCo partners must adapt the DiSSCo Training Strategy to their local settings by considering the diverse needs and interests of their organisations, their priorities, and their overall culture of their institutions. A template was provided to facilitate the development of the individual case studies. Partners had to define a clear plan for the digitization of the collections, identify possible risks and obstacles in its realization, identify the necessary competencies and skills required for the use of DiSSCo and, finally, select the most suitable training solution for their needs.

Chapter 8 concludes the document and presents a roadmap for setting up the DiSSCo Training Strategy, providing recommendations for the overall organizational structure, the content creation and the financial support needed for the operation of the DiSSCo training ecosystem.

## 02 CONCEPTUAL FRAMEWORK

### Cultural Change and Digital Transformation

The design and the development of the DiSSCo RI offers the opportunity to the involved organisations for embarking on a digital transformation journey. The key factor for a successful digital transformation of the organisation is the **acquisition of digital skills** at the executive level (this can happen by training up the current leadership in digital skills, training up the digitally savvy people in management skills or creating a new digital leadership role from scratch). **Strong leadership** is required as are more appropriate skilled resources in terms of staffing. **Digital capacity within the central team** alongside competency across the wider workforce should be built. More professional and flexible processes for project planning and management need to be put in place with a more robust infrastructure to underpin them. Alongside **user-centred design**, a **rigorous culture of analysis** is essential to inform a **continuous development practice** based on genuine digital products and the respective audience insights.

The participating organisations must **build up what can be defined as “digital cultural awareness” and “digital confidence”**. This means **developing digital skills for the entire staff of the organisation, regardless of their role**. However, **the staff of the organisation should be encouraged to increase their digital confidence**. This will help them to identify opportunities, and ensure they are economically and professionally viable. One of the barriers that are often identified in the processes undertaken across organizations involved in digital transformation is the lack of personal motivation. Getting all the staff members on board and allocating their responsibilities in relation to digital technology will motivate teams. In this framework, apart from the training, the DiSSCo Training Strategy will focus on assisting users’ behavioral change. DiSSCo users will perform a change in behavior and adapt a new culture and philosophy. For the proposed training approach to assist this change, we must introduce a solid theoretical framework and underline the main actions that need to be taken.

**It is necessary to foster a cultural change in terms of the planning and visioning of services**, so that the digital element can become an integral part of the thinking and planning process from the outset. The existing processes also need to be re-examined and re-proposed in ways that are relevant in today's digital world. The DiSSCo RI will catalyze the process of the participating organizations to find the optimal ways through which they can join forces and evaluate the feasibility of their joint endeavors, from a scientific, financial, organizational, and technical perspective.

**Finally, it is necessary to rethink the role of the organisation in relation to audiences and society at large**. Rethinking the opportunities offered by digital technology means developing meaningful relationships with new and existing audiences. DiSSCo organisations should work towards more open approaches whenever possible.

### Key Focus Areas for the Digital Transformation of the Organization

#### Organisational Focus Areas

- A cultural change in terms of how digital is perceived and where responsibility for digital content development sits within the organization. Devolving responsibility for

creating digital content across the organization. Adapting the organisation's internal structure and working model to the digital era. Implementing digital knowledge in as many areas and departments as possible to ensure that the digital and analogue contents are integrated and closely interlinked in a unified approach.

- Investing in digital capacity and skill building. Digital skills are not a core competency of an organisation's staff, so they need to be specifically developed. But improving the digital literacy of existing staff needs is not just about providing training. Internal meetings are also an opportunity for digital staff to share their knowledge with other colleagues, by showing and explaining digital production documentation such as wireframes, functional specifications, workflow diagrams, and analytics reports.
- Empowering staff and audiences to use the digital resources by developing user-friendly methods and tools.
- Developing a business plan for digitization to support the rationales for digitization initiatives.
- Becoming more user-centric and user-led and investing in audience research to gain valuable insights into the motivations, behaviour and attitudes of people who visit the collections online or physically. Conduction of surveys, focus groups and usability testing, and using digital analytics to focus on the elements that users like, and improving aspects that they have issues with.
- The most important document that a museum must create and keep up to date is its digital production roadmap, which should record all the digital activities in progress, regardless of the stage they are in. This document can help to communicate the current status of digital production projects in real time and encourage decision makers to monitor the work and its progress in relation to organisational objectives. Collecting, analyzing, and communicating accurate and timely data to all units. Before a new idea makes it onto the digital roadmap, it should meet a set of clear criteria that are derived from the organisation's key digital principles, objectives, and digital KPIs.
- Organisations should base their strategy on audience behaviour and evidence-based insights into their audience's needs and preferences, understand how audiences use the existing website(s) or respond to the existing social media presence and figure out what they want from it before investing in new platforms.
- Above all, organisations should think of 'digital' not just in terms of new technologies or infrastructure, but in terms of a new relationship with audiences (collaboration, co-creation, sharing and openness), and an opportunity to produce and showcase new types of work for a digital age.

#### **NHC Focus Areas**

- Identification of existing digital assets — and assessing methods used for creating and managing them — at the unit level. Development of the requirements for life cycle management of digital assets to ensure immediate access and long-term preservation. Documenting rights, restrictions, and security requirements for digital assets, clarifying access and use issues, identifying what assets can be made readily available. Implementing technical best practices and standards for capturing, creating, and using digital assets, and incorporating them into processes and systems.
- Developing and implementing a methodology for projecting future digital asset storage and backup requirements, to create sustainable and optimal storage architecture.
- Ensuring that trusted digital repositories are available for digital assets requiring long-term preservation and access.
- Inventorying all Web and New Media tools/functionality and determining the core set to be provided as a shared solution platform (it should include enterprise applications

like ecommerce, online donations processing, customer relationship management, search, analytics, and social networking).

- In addition to the objects and specimens themselves, museums organisations digitize the research, descriptions, and interpretive information that places them in context and gives them meaning.
- The organisation audience is becoming increasingly digitally adept and equipped with their own sophisticated devices for engaging, contributing, and sharing content.

#### **Developing Partnerships**

- Building strategic partnerships for content development and management that protect public interest and access.
- Establishing guidelines and developing templates for digitization sponsorships and partnerships.
- Supporting the growing role of mobile devices and configure the museum's sites and exhibitions for availability to wireless/handheld devices.
- Recruiting and training a core Web support team to develop technology solutions that can be made available to units on a free and/or cost-chargeback basis Analytics: Work with units to establish success criteria for individual site performance.
- It is essential to discover the interests of the audience that the organisation wants to address.
- Understanding the power of data. Data can be enormously useful if it is collected and used in the right ways. But understanding the data an organisation holds, gathering it and 'cleaning it' so that it can be used to inform decision making takes time and requires a clear understanding of analytics.
- Digital presents a genuine opportunity to involve the audience in questions they are passionate about and harness their input into extending knowledge and awareness.

### **Landscape Analysis of Best Practices for Training Delivery**

In this section we will focus on the landscape of the training courses that are offered by NH organizations and institutions. The analysis is mainly based on the work that has been done in the framework of the SYNTHESYS+ project. That work resulted in producing the Deliverable D2.3, an initial catalogue of training courses offered by the participating institutions when tackling the 5 different dimensions in which the DiSSCo Research Infrastructure is rooted, namely Technology, Data, Governance, Scientific and Financial aspects. The work carried out under SYNTHESYS+ task N2.3 analyzed courses, where the participation of experts from NH institutions is crucial. Important is also the tooling-up of the scientific community in their different areas of expertise. The courses can address the needs of different stages in the careers of the staff ranging from early-career investigators, young professionals to advanced and more experienced senior staff members. In this report we will refer to them generically as "training activities" to be understood within the scope explained here above. According to the SYNTHESYS+ analysis, the training activities organized by NH institutions can be roughly divided into four categories: Research-oriented; Collection-oriented; Digital-oriented and Policy-oriented.

Based on the work of SYNTHESYS+, we present here the definition of these categories and their scope in the framework of DiSSCo.

**Research-oriented training activities.** NH museums and botanical gardens represent geo- and biodiversity repositories playing crucial roles for research in different biological and



earth sciences disciplines. The long-term sampling and recording of specimens and specimen data through the centuries allow the reconstruction of natural patterns and processes. The scientific staff (i.e., researchers collecting, sampling, observing, or documenting new specimens in the field to study and answer scientific questions) is, therefore, best placed and qualified for providing the training activities in research disciplines such as taxonomy and nomenclature, identification and classification, evolutionary biology, ecology, systematics, and many more. In our analysis, we call it "specimen- based research". In the last two decades, this kind of training has been expanded by molecular and analytical research, where processing and analysis of big data are crucial. Scientific illustration courses are complementary to this group, representing one of the oldest training courses museums provide to future professionals to illustrate the publications. There has always been a great interest of the wider public for these very detailed and beautiful drawings. The courses have lately become popular with artists and the public. The discipline evolved to include digital technologies either complementary to hand drawings or in some cases replacing them completely. Modern techniques of photo stacking or photogrammetry also enable sharp in-focus photographic images in all layers of the specimens, which was previously only possible with drawings. These techniques are now all part of such training.

**Collection-oriented training activities.** NSCs are rich repositories of objects representing the natural world. They are a physical knowledge base about the history of our planet and the evolution of life. They can as such be assimilated to a database containing comprehensive reference information. Natural science institutions require special buildings and digital infrastructures to properly house, exhibit, and conserve the collections. To make the collections openly accessible - both through physical and digital access -to not only visiting researchers, but also to the public, they also need to invest in appropriate and secure facilities. The vast variety of object types in the collections (from animals and plants to minerals or related notes, letters, and books their sizes (from virus to giant dinosaurs), mode of conservation (e.g., dry or in fluid, thin-sections, or boreholes), vulnerability and great importance for research (e.g., type specimens, extinct species) and for mankind in general (e.g., Stanley's or Darwin's field notes) is challenging and requires experienced staff such as collection managers, curators, IT managers or legal experts, who can keep collections curated, safe, accessible and growing. This defines the importance of NH institutions participating in teaching activities and exchanging their experience in collection management. The training activities in general are structured around the basics of collection maintenance: preventive and remedial conservation, specimen curation, mounting or replicating specimens, handling and transportation, collection techniques, and museology. There are also training activities on the quality of the storage environment and collection assessment. Indeed, due to digitization, another group of training activities emerged, around comparison, selection, and use of collection management systems (e.g., Brahms, Botalista, Colhelper, Darwin Core, DINA, Specify or Pluto). Additional collections are addressed next to the preserved collections such as the construction, the use and management of DNA and tissue banks, living collections, or seed banks.

**Digital-oriented training activities.** With the development of digitization of NH specimens and the increasing amount of data becoming available for digital and extended specimen information, a need for new techniques and digital skills has emerged. This is reflected by

the training activities around digitization techniques, standardization and integration of collection data, and citizen science integration. NSCs documentation has evolved from solely handwritten labels and index cards on physical specimens into suites of interconnected over time enriched data. Physical specimens, from minerals to vertebrates, are now linked to potentially limitless digital resources. This concept of digital enhancement was coined by Webster (2017)<sup>2</sup> as the "extended specimen" and represents the next generation of NH collections (Schindel and Cook 2018)<sup>3</sup>. While training activities around digitization are still closely connected to physical collections, the third group of trainings, digital-oriented trainings, targets a wide field of activities using the data alone: "discovery and registration of data sources; acquisition of data; curation and preservation of data; adding universally unique identifiers; standardizing the content with controlled vocabularies; and making data freely and openly available to individuals and machines" (EU BON policy brief 5)<sup>4</sup>. Examples are trainings in data mobilization ("BID Capacity Enhancement Workshop "Biodiversity Data Mobilization", by GBIF), storage and use ("Long term data storage", by MfN), software for data analysis and processing ("QGIS for distribution data", by RMCA).

**Policy-oriented activities.** NH collections were never a sealed treasury, but on the contrary, they have always been open to researchers and professionals, provided the rules of handling and use were respected. Institutional internal policies and guidelines regarding handling of specimens and access to collections have been part of collection management training. Big data, open knowledge, looking for a fair and equitable share of biodiversity resources, and an increased interconnectedness in our modern world have brought new concerns about the origin, exchange, and use of genetic resources and data, and new challenges for data holders to apply correct policies and legislation when dealing with physical specimens and digital surrogates. Such training courses provide advice and guidance on how to deal with various international conventions (e.g., CBD, CITES, Nagoya Protocol) or how to apply a correct policy (Open Sciences, GDPR, Intellectual Property Rights (IPR), etc.).

#### *SYNTHESYS+ Catalogue and Recommendations*

SYNTHESYS+ project has produced a detailed catalogue of existing training, supplied by the project partners and a few additional SYNTHESYS+ collaborators, that is available to the DiSSCo community. The catalogue includes detailed information on the training courses: training title, institution, city, target audience, length, in-take capacity, frequency, the position of the trainer, language, format, fees, and certification. The project documentation includes an in-depth assessment of the catalogue's training landscape in view of DiSSCo training needs. Based on this assessment, recommendations have been formulated for the construction of an efficient and proactive "DiSSCo training programme". More specifically, the assessment involved organizing the catalogue of training into Key Training Areas (KTAs), to define the broad educational categories, domains, and areas on which DiSSCo organizations trainers are currently concentrating. Using the KTA classifications, the training landscape was mapped to the DiSSCo

---

<sup>2</sup> Webster MS, editor. The Extended Specimen: Emerging Frontiers in Collections-based Ornithological Research. Boca Raton, FL: CRC Press/Taylor & Francis Group; 2017.

<sup>3</sup> Schindel DE, Cook JA (2018) The next generation of natural history collections. PLOS Biology 16(7): e2006125. <https://doi.org/10.1371/journal.pbio.2006125>

<sup>4</sup> <https://zenodo.org/record/188391/preview/EU%20BON%20policy%20brief%205.pdf>

Implementation Readiness Levels (IRLs) (i.e., Technological, Data, Organization, Scientific and Financial), which correspond to the areas that DiSSCo needs to become proficient and fully operational. This analysis allowed for the identification of gaps, in terms of areas that are not covered yet or barely covered by the organizations related training landscape but are critically needed to fulfil the IRLs. The overall recommendation of the SYNTHESYS+ D2.3 was that within the next 3 years the following activities had to be undertaken:

- (1) Establish an exhaustive inventory of the available training activities by broadening the criteria and widening the communities inventoried, for instance including the training programs of other related infrastructures and international initiatives as well as courses from the academic sector;
- (2) Address further training topics in complementary areas linked to the Natural History (NH) community, such as general IT skills or legal and financial aspects; and
- (3) Adjust and expand the boundaries of the catalogue according to the DiSSCo training objectives and needs once DiSSCo services are fully defined and integrated.

SYNTHESYS+ recommendations suggest that to coordinate efforts and better disseminate the catalogue of training developed, collaboration will need to be pursued with the existing Distributed European School of Taxonomy (DEST), an initiative run by the Consortium of European Taxonomic Facilities (CETAF). This will be the platform used to allocate the catalogue of training resources through which the target audience will be efficiently outreached. As an optimal solution offered to the DiSSCo community and NH training providers, DEST is acting as the physical and online platform showcasing to the community the NH training on offer. It also has an interface for the training providers, as well as for the trainees, dedicated to administration. The produced catalogue of training activities will feed the DEST platform and contribute to increasing the richness and up-to-datedness of the content, its robustness in terms of data quality and criteria, and its networking role notably through the access to trainers' contact details.

The SYNTHESYS+ report concludes by proposing that the catalogue, methodology and analysis done in the framework of the project be used as a tool and guideline to develop the training activities suitable for DiSSCo needs, as a structure and content provider for DEST and as a collaborative incentive and set of information to foster the use of the existing rich training offer among the NH institutions and promote and enlarge training activities throughout the entire community. Specific recommendations have been formulated in the SYNTHESYS+ project documentation and they are further discussed in Chapter 4 of this deliverable. The recommendations of the SYNTHESYS+ project have formed the main reference for the needs analysis survey that was performed in the framework of the work in Task 2.1.

#### *Capitalizing on the experiences of DEST*

The Distributed European School of Taxonomy (DEST) transfers knowledge between current and future generations of taxonomists by providing high quality education and prepares students for future taxonomic careers. The DEST offers education and training opportunities to students and professionals from any nationality studying, working or interested in the field of taxonomy, biodiversity, geodiversity and conservation.

**Training program in Entomology (special. Diptera Syrphidae), emphasis on collection management and bioindicator use**

Courses:



**Description**

The course will give an introduction to the taxonomy and the systematics of hoverflies, insects that play an important role in pollination of both crops and wild flora and are used in organic control of pests. Hoverflies are also used as bioindicators of biodiversity in natural and seminatural ecosystems; the Syrph the Net method will be explained in details. Information about other pollinators and bioindicators of biodiversity and about museum collection management will be supplied.

**Trainers**

**Carla Corazza**, Civic Museum of Natural History of Ferrara. She is a biologist that since 1990 manages the Ecological Research station of the Museum. She organises taxonomy courses on terrestrial invertebrates since 1999.

**Daniele Sommaggio**, University of Bologna. He is an entomologist with a large experience in taxonomy and systematics of hoverflies and in the application of the Syrph the Net method for the assessment of biodiversity. He's involved in many European projects dealing with pollinators.

**Giovanni Burgio**, University of Bologna. He is full professor of applied entomology.

**Dates of Training period**

26-30 September 2022

**Duration**

5 working days, 40 hours

**Location**

Ferrara, Civic Museum of Natural History and System of the Museums of the University  
Protected Area of Valli Mirandolesi, ITALY

**Course's language**

English

**Figure 2.1:** Recent DEST Training course in Entomology. The course gives an introduction in 40 hours (5 days) to the taxonomy and systematics of hoverflies, insects that play an important role in pollination of both crops and wild flora and are used in organic control of pests.



It was established by prominent taxonomists and other international partners during the CETAF initiative EDIT, an EU-funded project. Within CETAF, training is central to building capacity within the community. It is a means for the 5,000 scientists from across the community to share expertise and learn from each other. The member organisations are involved in an increasing number of training programmes in different areas related to taxonomy, taxonomic research, and natural history collections.

DEST activities aim to improve the flow of knowledge between students and scientists and raise awareness of our field within society at large by opening access to taxonomic expertise and information. Training opportunities are offered by CETAF or by the member institutions and other partners within the CETAF activities and initiatives. DEST is offering training programmes on 3 areas covering different aspects of biodiversity research:

- Modern taxonomy programme
- Expert-in-training programme
- Collection management programme

### Lessons Learnt from BIOTALENT Online Course

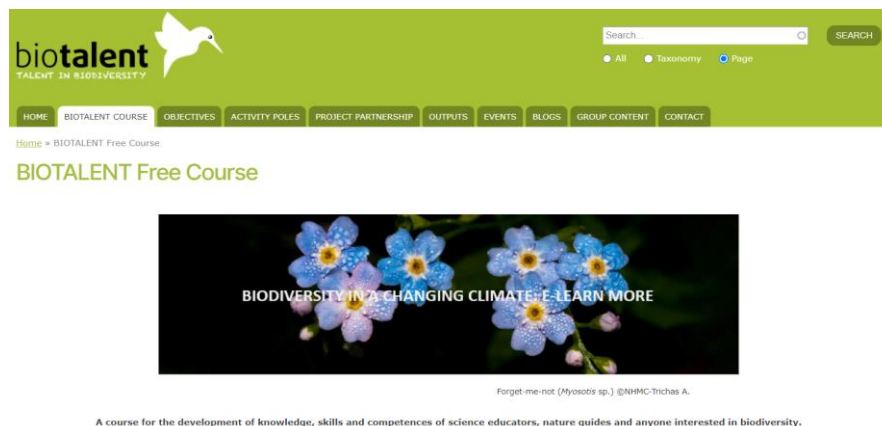
The DISSCo Training Strategy will be based on the outcomes and the lessons learnt from the BIOTALENT course that was developed in the framework **of the BIOTALENT project funded by ERASMUS+ KA2 Strategic Partnerships for Vocational Education and Training**. The pilot course targeted biodiversity and climate change using climate sensitive model species to develop learners' competences in those key fields. The training programme was centered on two groups of model organisms (herpetofauna: amphibians/reptiles & medically important plants) on which best practices in blended educational programmes in biodiversity can be worked out and demonstrated. Participants gained insight into the problem of biodiversity loss and climate change and learnt about the model organisms that:

1. reflect the profound changes of the global environment, and
2. show painfully what we are losing.

The programme includes 80 hours blended instruction of the BIOTALENT project consisting of two main learning components: i) an online component with two theoretical modules (40 learner hours) and ii) an attended component with one training-on-the-job module (40 learner hours).

The online component of the course is split into a general module (biodiversity/climate change/collections/labor market) (20 learner hours) and a case study module: learners can choose either herpetofauna (20 learner hours) or medicinal plants (20 learner hours) as case study organisms.

The online component comprises one general module and two case study modules. Learners of the course will study online both independently and with tutors with a split of: 50% guided learning (videos, presentations, notes to read, quizzes, etc.) and 50% own research (producing an essay, presentation, etc.). This gives learners the opportunity to learn at their own pace. The tutor mediated sessions (2 tutors/module) were set on specific dates and times within the time frame of the module. For the synchronous component (2-3 hours/module), the group of learners was split into smaller groups and the lessons were carried out in several sessions at different times.



**Figure 2.2**  
The website of the BIOTALENT hybrid course.

The online part of the course aims at unlimited participation and provides open access to anyone interested to join the course. Given the training topic, there is a huge potential

audience to reach, although as a pilot course in the framework of the project the audience was limited to 400, enabling a good follow-up and analysis. To promote and market the blended e-learning course to potential participants, various strategies were used.

The entire course is based on the **Inquiry Based Learning (IBL) methodology**, a constructivist approach where the overall goal for learners is to build knowledge by themselves. Inquiry Based Learning incorporates many current learning approaches such as project-based learning, problem-based learning, design thinking, etc. Equal emphasis is put on content and in the process of learning, learners are actively involved in constructing understanding through research and several consolidation activities, many of which bring them outside of their learning settings. Each course theme includes different steps through which learners build knowledge by themselves. In Step 1, learner's prior knowledge is ascertained through a quiz or problem-based activity. In Step 2, after going through carefully selected resources, learners retake the quiz or confirm their answer of the problem-based activity. In Step 3 they work out assignments in the consolidation activities. All learners' work is uploaded on their workspace (padlet) and posted to a wall (lino). Through a procedure of 'Meet and Share' in Step 4, learners have the possibility to share their understanding and findings with their co-learners, learning thus from and with each other. They can comment, compare and evaluate their co-learners' work.

The implementation of the BIOTALENT course has demonstrated the potential of the blended learning model as the optimum practice for the organization of adaptable modular training courses as it would be also the case in the framework of DiSSCo. Course templates have been developed to serve as models for best practices in future training courses that will be developed beyond project lifetime. The purpose of these templates is to provide a clear starting point for future course development. Each template is set up into learning modules, units which can be used in fully online or blended future courses. Learning modules are a useful way to organize learning activities and can be organized around a learning plan, a certain topic, a week in the semester, or however is decided to structure the course. A modular course design provides an instructional sequence and helps to organize the content as for BIOTALENT content providers, trainers and learners. Creating a template simplifies new course creation and course updates for future training programmes. Each of the templates are easy to customize by adding or deleting content or content areas.

#### *ICEDIG: Active Involvement of Citizens in the mass digitization process*

ICEDIG was the first step to help tackle the complex challenge of digitizing natural science collections and providing access to collections data via DiSSCo. In support of DiSSCo, ICEDIG has devised the necessary plans and capacity enhancements to make the future Research Infrastructure for natural sciences collections operational. It was the goal of ICEDIG to devise the structural pillars of DiSSCo by setting up the necessary technological, socio-cultural, and organizational features to enable the operation of a unified access point to bio and geo-diversity data. ICEDIG has paved the way to mass digitization of European natural science collections and the subsequent access to all related data in a harmonized and integrated manner across Europe.

The recommendations of the ICEDIG project have been published in a conceptual design blueprint for DiSSCo. In this section we highlight the recommendations related to the active involvement of the citizens in the digitization process. For properly engaging citizens with collections and collection digitization, deep understanding of the

relationships between collections, particularly digital collections; formal and informal education; museum-related citizen science; and the skills and knowledge that these can advance is needed. It seems clear that while national and cultural differences can have an impact on citizen science and education, the similarities – for example in what approaches are likely to engage people – are more important than the differences. Thus, a few general business model principles can help to guide future projects that engage citizens with collections<sup>5</sup>. Time spent in considering when it is worthwhile (cost beneficial) to embark on a citizen science activity, on precise definition of the contributors/audience for the activity, on how to engage the contributors, how to raise the skills and knowledge levels of participants and how to sustain their interest for the duration of the work – these can all help to maximize the opportunities for collections to be successfully used in citizen science and education. This can increase the engagement, skills, and knowledge of citizens, whilst at the same time achieving objectives of the collection-holding institutions themselves around digitization, curation, maintenance and use of their collections. For this reason, the ICEDIG recommendations ask to recognize the likely **future increase in citizen science involvement with natural science collections**. DiSSCo should further develop a package of business model principles and guidance that collection-holding institutions can use to design and manage citizen science engagements and activities to their collections.

Furthermore, it is advisable to ensure that attribution details are preserved in transcription datasets, transferred to collection management and systems and published publicly when such data is published. Darwin Core and GBIF Metadata Profile standards allow to some degree to describe also volunteer involvement in data collection and enrichment. The recommendation for the representation of attribution metadata published by the Research Data Alliance (2018)<sup>6</sup> makes this easier to achieve. In this framework the ICEDIG project recommends that the involvement of citizen scientists in DiSSCo data work and activities must be properly acknowledged and attributed, for example using Research Data Alliance recommendations for the representation of attribution metadata.

---

<sup>5</sup> <https://zenodo.org/record/3364541#.YxvDMnZBxPY>

<sup>6</sup> <https://www.rd-alliance.org/group/rda-tdwg-metadata-standards-attribution-physical-and-digital-collections-stewardship/outcomes>

## 03 TRAINING AS PART OF THE DIGITAL STRATEGY OF THE ORGANIZATION

### Introduction

This chapter highlights the importance of integrating the training strategy into the overall digital transformation journey of the organisation. It highlights the key parameters that could affect the process.

- A defined digital strategy allows organisations to leverage digital technologies to connect with their audience, protect their content and cultural data, support their mission more fully, and do so on a budget fit for a collection.
- Building on excellence and the potential for excellence throughout the organisation by focusing on web-publishing fundamentals and improving access to collections, community, and content across all platforms.
- Increasing online access to the collections is part of the equation for promoting learning.
- Supporting findability (the combination of search, information architecture, and design that enable digital information to be found).
- Supporting new kinds of learning, innovation, and knowledge creation inside and outside the organisation.
- Emphasizing the role of the organisation as the preeminent facilitator of learning for national and global audiences.
- Thanks to going digital, organisations can increase their appeal to and relevance for younger audiences.
- Learning as a hybrid of formal education and self-directed discovery that can be brought together and enhanced by online tools and communities.

*Adopted from "Digital Strategies for Museums 2021/2022"<sup>7</sup>*

### Factors affecting the development of a digital strategy of the organization

The digital strategy of the organisation depends on many factors: financial resources, but also open-mindedness and the right leadership, able to manage and to drive the change. A clear definition of objectives and priorities, a detailed change plan and a participatory design that involves all the departments of the organization could catalyse the process. In fact, no digital product emerges if significant process innovations, new behaviours and methodologies have not been presented in such a way that provide a promising new landscape. It is necessary to inform all the organisation employees and collaborators about the potential and benefits that the DiSSCo RI can generate in the institution's operation. Organisational change will be achieved only if all the staff identify themselves in the organisation's mission and share the tools chosen to achieve it, digital or non-digital. As DiSSCo RI works for the digital unification of all European natural science assets under common curation and access policies and practices that aim to make data easily

<sup>7</sup> <https://www.linkfactory.dk/sites/default/files/2021-10/Digital%20strategies%20for%20museums%202021%3A2022%20%20LinkFactory.pdf>



Findable, more Accessible, Interoperable and Reusable (FAIR), it is crucial for the contributing organisations and their staff to realize that their collections are now part of a wide ecosystem. The staff must develop a feeling of ownership for this new ecosystem, to get familiarized with the technological tools offered, to overcome fear and anxiety of advanced technological tools. In such a way, a behavioural change will happen, and the new system will be smoothly integrated in the everyday tasks of the personnel and in the operation of the organisation. The effective engagement of the user communities is also crucial. Analysis of the diversity of user communities served by DiSSCo will provide a sound knowledge for defining a framework of development of services tailored to those communities and adjusted to address societal and economic challenges. DiSSCo Prepare will help the RI develop a better understanding of how to evaluate (cost-benefit) ever-changing scientific drivers and to translate them into functional requirements for the operation of the RI.

Since the improvement process is continuous and incremental, to consolidate the positioning of the organisation, it is crucial to conduct extensive and constant market research, and to decide what kind of a digital product is worth investing in (see for example the analysis presented in Chapter 5). This prevents the institution from wasting resources for “trendy” products that are little in line with its overall strategy. Moreover, using too many digital products can have a misleading effect, compromising the users’ understanding of the organisation’s mission. At the same time, investing in big data analysis that could be offered from such a large-scale infrastructure to measure the impact of the actions is a way to constantly assess the quality of the cultural offer and its continuous improvement.

The starting point of an effective digital strategy, that is going to be followed by significant investment on digital infrastructure and on human resources, is to develop a good understanding of the needs of the users’ communities. Human resources are instrumental in achieving DiSSCo Prepare objectives as a project and in ensuring the successful implementation of DiSSCo RI at large at a later stage. Acknowledging the challenge inherent in upskilling the organizations’ workforces in a fast-transforming technological landscape, DiSSCo Prepare devotes specific effort to the preparation of DiSSCo facilities and their staff to acquire the skills and competencies needed to enable them to optimally use DiSSCo when addressing digitization, exploitation and enrichment of digital collections. The overall strategy of each organization should be to provide support to enhance technical, human and process capacity needed to follow DiSSCo requirements. Equally important to the effective and efficient implementation of DiSSCo is equipping the infrastructure with the best possible managerial team. To that end, DiSSCo Prepare has given support to the training of DiSSCo community which lead to the obtention of the *‘Certificate of Excellence in Management of RIs’* provided by Bicocca- University of Milano, to 3 individuals and to the Research Infrastructure involved community at large. Moreover, DiSSCo Prepare will draft the necessary Human Resources (HR) policies that will support an inclusive and balanced approach in acquiring and retaining expertise and ensuring gender balance. Altogether, the DiSSCo executive bodies will help to upgrade the skills and competencies of personnel at each participating institution, by providing necessary advice for capacity enhancement.

As previously mentioned, this will work if the whole organization is actively involved. At this stage of the transition, then, the most effective solution would be to create a leading group, which crosses the involved departments (conservation, communication, ICT, marketing, educational) and encourages the organisation’s entire staff.

## Opportunities for small museums

Most of the museums in the world are small. Because of their reduced resources, they are affected much more by the current global economic crisis than large museums. In some European countries, most museums are dependent financially on local governments (which sometimes results in less autonomy in the production of digital content). Digital technologies, however, offer new solutions at affordable costs especially to the advantage of the local government financial backers. Even if for many small museums the costs of developing and managing a website are unsustainable, **the spread of social media has greatly reduced the barriers of access to digital communication, providing very powerful tools for the creation of networks.** For small museums, even more than for big museums, it is essential to abandon the traditional model of working in a “closed” world. In the digital world, even a small niche museum can find its target audience or other niche museums across the world with which to collaborate and create projects. Today, even small museums are called upon to cross their boundaries and to look beyond them, to develop new activities to increase their networks and to establish strong alliances with other museums, geographically or thematically close, but also with other institutions not belonging to the museum industry. Collaborating with universities for the development of digital skills can create, for example, a breeding ground for new generations of digital professionals. More generally, building solid networks of support and collaboration, inside and outside of the industry, allows more effective networking in the search for resources, and provides an **opportunity to create moments of informal training with the big museums, where it is possible to share their knowledge and compensate for the lack of experts.** In small museums, in fact, due to the lack of human resources, every person must carry out several tasks that involve more than one discipline.

Thanks to the effects of technologies and networks, small museums can benefit from the “Long Tail” effect, theorized by Chris Anderson<sup>8</sup>, to explain the commercial and economic model implemented by Amazon and Netflix. For these giants, the volume of total sales of less popular products exceeds that of very popular products. Anderson concludes, therefore, that an unlimited offer creates an unlimited demand, mainly for the benefit of niche products. In the museum industry, digital technologies also allow smaller museums to reach the global market and, if their networks are solid, to get more visibility. Therefore, while the mass culture of consumption is transforming into an archipelago of niches that everybody can reach thanks to digital technology, the attention and interest in big museums also positively affect niche museums, if these are included in territorial communication systems that widens the user’s choice. Finally, **reasonable resource planning** could be extremely advantageous. When financial resources are scarce, it is better not to disperse them: it is preferable to choose fewer activities to carry on as best as possible, in terms of work quality and development. To choose the right platforms and tools, it is important to design a strategy and focus on a particular kind of potential users.

## Skills and profiles that facilitate the digital transformation of the organisation

Together with investments and digital infrastructures, staff competences and interest can set more than anything else how quickly the organisation will move in the digital world. What the industry needs is a good **mix of competences**, ranging from art history to digital communication, from online marketing to cultural management and information

---

<sup>8</sup> C. Anderson, The Long Tail, How Endless Choice is Creating Unlimited Demand, 2009.

technology. Even more useful is the intermixing and collaboration among different professionals who mutually exchange their expertise.

The digital skills which are essential to address the current changes are related to communication, big data analysis, content production and user experience. As far as **communication** is concerned, senior social media specialists are required for a strategic use of social media. The DiSSCo RI would have to promote the development of strategic skills needed to get a good level of engagement across the community and create the greatest possible impact. **Data analysts** are crucial for reading the information collected about the users and transforming them into activities and new priorities, in support of the museum's strategic choices. The museum needs all the necessary professionals responsible to produce **digital editorial, video, and photographic content**. It is important that the content is relevant to the context and that the channel used is meaningful for the addressed public. Finally, the **user experience** is essential to implement any digital project and product, because the on-site and on-line visit to the museum is to be conceived as an experience for the user. It is, therefore, useful to have personnel skilled in designing systems with which users can interact effectively and naturally and to know how different audiences relate with digital technologies, as well as to have good **interaction, digital and graphic design skills**.

Nevertheless, digital skills are not everything. To work on digital collections and put a collection online, for example, it is necessary to have **copyright experts**, who know how to proceed confidently in this field. In addition, the museum staff often mounts resistance to the implementation of a digital transformation plan. That is why it is important to have some **soft skills**. People sometimes refuse additional tasks, and they are afraid of being immersed in a fully digital world. As technology advances in everyday life and in interpersonal relationships, many things are changing, and people are gradually realizing that their personal growth depends on their development of digital skills. Still, to make them accept the change, the best thing is to present a clear and detailed strategy about what to do and where to go.

A good **leader**, someone who knows how to encourage and coordinate the work of motivated and charismatic people, is very important. For example, the results of using social media can largely differ, depending on whether the people in charge have the charisma, communication and persuasive skills to generate interest and loyalty within the community. Not only that: **openness to changes** and **lifelong learning**, and a **sense of initiative**, are essential in all departments and at all levels. The staff of a museum should look beyond the scientific sector, taking an interest in everything that concerns the economy and society. They should be curious enough to go beyond their field, and to understand what happens in the world, following the latest developments in all sectors, including the digital one. Sharing is becoming more important than possessing. This concept is behind the choices of several cutting-edge museums that made their digital collection available without restrictions. They were inspired by some widespread social dynamics related to sustainable transport (from car sharing to Uber) and low-cost tourism (from Airbnb to experiential tourism). This is an example of how contamination between different fields can be strategic and how working with different partners fosters new ideas. The key is, therefore, planning strategically, and looking beyond short-term goals. Moreover, working with people from different backgrounds is desirable, both inside and outside of the museum.

The **ability to work in teams** is crucial, as well as being open-minded and keen on collaborating. The quality of work largely depends on interest. Skills and dedication can

be developed only if there is passion. **Stimulating interest and passion for digital technologies is, therefore, the key for promoting change.** The perspective should be that of “gardening management”<sup>9</sup>, where the management’s objective is the development of the individual: the development of an institution depends on the development of the individuals who make it alive every day with their work. The profiles needed in this moment of transformation should be able to **combine tradition and innovation.** They have developed curatorial, scientific, and editorial skills, and, at the same time, are able to combine “traditional” knowledge with a thorough knowledge of the new digital media. In most cases, it is preferable to **train the existing profiles to develop new digital skills,** rather than hiring new personnel, especially considering the limited financial resources available to most cultural institutions.

Today a **key figure** is emerging in the promotion of a digital culture and the acquisition of digital skills necessary to modernize the museum: the **Cultural ICT Consultant**<sup>10</sup>, who is responsible for the organisation’s digital strategy and the financial planning of technological resources. This profile is strategic for all the organisations that want to take up the challenges of digital transformation. Not only do they know everything about planning and managing an effective digital communication, but they also play a mediating role between the collection and the outside world, being able to talk to the different stakeholders, which are either partners to work with, or different online and offline communities.

---

<sup>9</sup> <http://www.ilgiornaledellefondazioni.com/content/la-vera-risorsa-dei-musei-italiani-sono-lesue-persone-perch%C3%A9-il-denaro-segue-le-idee>

<sup>10</sup> <http://www.project-musa.eu/wp-content/uploads/2017/03/MuSA-Museum-professionals-in-the-digital-era-full-version.pdf>

## 04 TRAINING NEEDS, CAPACITY BUILDING AND RECOMMENDATIONS

### Introduction

The compilation of needs for skills/competencies, along with the identification of training providers/platforms that will be presented in the next chapter, provide the building blocks in terms of information and analysis for the development of the DiSSCo training strategy that responds to the needs of the DiSSCo research infrastructure, but also the best channels to deliver the know-how and facilitate knowledge transfer to the various target audiences (data suppliers and users). The envisaged capacity building activities to be conducted in support to DiSSCo Research Infrastructure (RI) will cover both the side of the data suppliers (collection managers, data digitisers, museum technicians, etc.) and the data users of DiSSCo (researchers, policy makers, students, environmental Agencies, NGOs, etc.).

**Recommendation #2:** Less well-covered KTAs such as “Equipment use”, “Training multipliers” “Text and Media” and “History of collections” need to be investigated more in-depth by DiSSCo Prepare Project partners in order to best explore these new areas specificities and requirements.

**Recommendation #3:** Further investigations on the motivations from institutions for providing trainings with qualifying certifications and for charging fees are required to set up a coherent and relevant assessment of needs and possibly a business plan.

**Recommendation #4:** DiSSCo should foresee a lighter work load for trainers through the development of digital tools simplifying administrative and repetitive tasks.

**Recommendation #5:** DiSSCo should take into consideration the growing lack of space in many European NH institutions located in historic cities and work towards a strategic plan to improve the physical and working/training conditions.

**Recommendation #6:** DiSSCo should promote open access to training software and develop financial and sustainable strategies to invest in IT material tailored and adequate for training.

**Figure 4.1:** An indicative list of the recommendations delivered under the SYNTHESYS+ project. The recommendations highlight several key needs that the DiSSCo Training Strategy must consider.

A key step for the development of an effective training scheme is the identification of the skills gap and relevant training needs in relation to the organization and operation of DiSSCo, i.e., to populate, manage, and drive the DiSSCo research infrastructure in the five different **Implementation Readiness Levels** (IRLs) - namely Science, Data, Technological, Organizational and Financial. To that end, a survey was launched among the project partners that drew and built upon the methodological approach and recommendations delivered under SYNTHESYS+ task NA2.3 "Catalogue and survey of training activities". That catalogue gathered the courses offered by the community under different areas, categories, and subcategories, as a training offer currently being delivered, with the assumption that those blanks still not covered would necessarily be considered as a need. The new survey launched under T2.1 of DPP aimed to complement those aspects focused on the offer side, with others centered on the specific demands, to widen the scope and

the number of respondents, detect concrete areas to fill in and improve training, and corroborate validity of previous assumptions and premises.

## Methodology

The work done in the framework of SYNTHESYS+ NA2.3 (T2.3), targeting exclusively specific project partners (10 in total), offered a unique reference point for the work in the framework of Task 2.1. The DiSSCo consortium provided a good landscape analysis of training needs of the different organizations involved, which differ, among other features, in size and geographical distribution. Within the 30 DPP partners, the survey was sent to all 27 research organizations, including natural history museums and botanical gardens, which already addresses a wider audience in comparison to the survey run. In this way, the survey administered offered an updated and deeper insight into training gaps and needs compared to the previous study of SYNTHESYS+. The survey behind the SYNTHESYS+ catalogue investigated the training offered by respondent organizations. The training needs were identified on the assumption that if no training is offered in a certain area there will be a training need; while this is a reasonable assumption to make, under DPP our aim was to bring the analysis one step further and form a more accurate picture on training needs and priorities in relation to DiSSCo IRLs. In fact, some organizations might not have immediate training needs in a certain area because they have decided to either outsource certain activities (e.g., fundraising or scanning of specimens), or hire new staff that is senior/ experienced in that area and does not need immediate training beyond induction (compared to more junior staff or re-training of existing staff).

The master document of the survey is available in **Annex 1**. The questions were developed by and tested within the T2.1 task team. The survey was conducted via an online (customized) tool, equivalent to google forms, hosted by the MfN in Berlin. The survey provided ample flexibility to respondents: most questions were "Multiple choice" or "Interval scale" questions, but several also included an option "other/please specify" to allow participants to provide further information or explain specific situations. The last two questions (questions 6 and 7) were actually "Inventory" type of questions, where respondents were asked to indicate existing training currently provided by their institution (question 6) and training needs of their institution (question 7). For each entry, respondents were able to include the title of the training and select one or more of the five IRL categories and relative subcategories. Question 6 (existing trainings) was aimed at completing/updating information already provided under SYNTHESYS+ project, while question 7 (training needs) provided an opportunity for respondents to give details about specific detected needs within their institutions in an open-ended way and also for the project team to cross-check the analysis from responses given with other questions when writing the report.

The survey on training needs made use of the IRLs (Implementation Readiness Levels) categories and subcategories developed under SYNTHESIS+ NA2.3 "Catalogue and survey of training activities" (for the full list see the **Annex 2**) to categorize the various trainings currently provided by DiSSCo partners and to identify training gaps and needs. The IRL categories and subcategories approach has been adopted as an overall approach throughout the work in the T2.1 training strategy to build each new step on previous ones and to develop work in a consistent way. Therefore, IRL categories and subcategories have been used to structure the core of the survey questions (question sections 2-5 and to help

respondents to categorize existing training courses (question 6) and training needs (question 7).

Such structure and approach will also facilitate the development of a future catalogue of training, which is comprehensive but also detailed enough for organizations to select modules to create tailored training to address their specific training needs. A few modifications to the SYNTHESYS+ initial list of subcategories have been introduced to better cater for needs in organizational support services (namely legal, fund raising, marketing and procurement).

Furthermore, the survey has been complemented with other methodological elements that served to improve, fine-tune and adjust the results of the survey: 1) semi-structured interviews with relevant DiSSCo Work Package (WP) leaders in order to gather qualitative analysis of some training needs and cross check information on training and skills needs in relation to the readiness level (i.e. in order to put in place the distributed digitized collections, specimen loans and sharing system and other aspects of the DiSSCo project); 2) brainstorming and discussions held within a task team that acted as a focus group to provide qualitative inputs and insights into broader contexts. The geographical and size diversity of DPP partner institutions represented in the DPP T2.1 team gave a good sample base of the DiSSCo consortium for critical reflection; 3) a working session (with a presentation and discussion) at AHM2 (2nd DPP All Hands Meeting), in a meeting attended by 33 persons. This allowed a broader audience of DPP beneficiaries and WP and Task teams to provide further input and feedback to test and enrich the analysis.

## Survey results compilation and analysis

### *Overall analysis of the survey results*

The Survey was distributed in 7 sections, each containing a set of questions (Q) and sub questions (sQ): Qs 1-2 address information on Institution, staff size and distribution; Q3 tackles each of the IRLs; Q4 focus on talent acquisition and management; Q5 is centered on training systems and policies; Q6 gathers existing trainings; Q7 faces training needs. The analysis of the results obtained is presented in this section, following the same considerations as for structuring the survey. A total of 16 out of the 27 consulted institutions responded to the online survey, providing a critical mass for analysis. Furthermore, they constitute a good landscape in terms of geographical distribution and institutional size. Half of the respondents (as per Qs 1 to 2.1) are within the Medium size category (8 out of 16), i.e. institutions with 100-250 staff. Still, all categories have some respondents (3 small institutions, 2 large and 3 very large). Good diversity among respondents is also observed in relation to collection size, with four institutions with less than 2M specimens, three with 2-5M specimens, two with 5-10M specimens, three with 10-15M specimens, and four with more than 30M specimens. Table 4.1 shows the name of the 16 responding institutions, their size, in terms of dedicated staff, the collection size and their location (country).

**Table 4.1:** *The participating Institutions and the size of their collections.*

Institution Name	Institution Size (#staff)	Collection Size	Country

MUHNAC, Universidade de Lisboa	small ( $\leq 100$ )	< 2 million	Portugal
Università degli Studi Firenze	small ( $\leq 100$ )	10-15 million	Italy
Musée national d'histoire naturelle of Luxembourg	medium ( $\leq 250$ )	< 2 million	Luxembourg
Universitetet i Oslo	medium ( $\leq 250$ )	5-10 million	Norway
Museum für Naturkunde Berlin	very large ( $> 500$ )	15-30 million	Germany
MHNC, Universidade do Porto	small ( $\leq 100$ )	< 2 million	Portugal
Natural History Museum of Denmark, University of Copenhagen	large ( $\leq 500$ )	10-15 million	Denmark
Agentschap Plantentuin Meise	medium ( $\leq 250$ )	2-5 million	Belgium
Narodni Muzeum	medium ( $\leq 250$ )	15-30 million	Czech Republic
Royal Botanic Garden Edinburgh	medium ( $\leq 250$ )	5-10 million	UK
Muséum National d'Histoire naturelle	very large ( $> 500$ )	>30 million	France
Senckenberg Gesellschaft für Naturforschung	very large ( $> 500$ )	>30 million	Germany
Magyar Természettudományi Múzeum	medium ( $\leq 250$ )	10-15 million	Hungary
Institut Po Bioraznoobrazie i Ekosistemni Izsledvaniya Balgarska Akademiya Na Naukite	medium ( $\leq 250$ )	< 2 million	Bulgaria
Freie Universität Berlin - Botanische Garten und Botanisches Museum Berlin	medium ( $\leq 250$ )	2-5 million	Germany



Institut royal des Sciences naturelles de Belgique	large ( $\leq 500$ )	>30 million	Belgium
--	----------------------	-------------	---------

When looking at the overall approach to DiSSCo RI, most respondents (11 out of 16) indicated a preference for a **dual role strategy**, i.e., their strategy in relation to staff and teams is to have the same team dealing with both the physical and digital collection. This statement has been consistently reiterated throughout the survey (see for example Q 3.1.2 and Q3.4.5). This statement clearly indicates a need to adjust role profiles and job descriptions to tackle a combined effort (in both, the digital and the physical environment) but also **the strong need to upgrade the skills and competences of existing staff to cater for the digital research infrastructure at all levels and dimensions** in which DiSSCo RI anchors, i.e., from Science and Data to Technological, Organizational and Financial.

Yet, when looking at the level of maturity of such adjustment processes, it is clear (Q3.1.4 and Q3.4.3) that in most cases **institutions are in very early stages of the transformation process or they have not even started the process.**

A significant majority of institutions responded to have training policy and systems in place (Q5.1 to Q5.9): out of 16 responding institutions, half (8) have a formal training policy, 10 have a training manager/officer to oversee training needs, and 12 have a budget allocated for staff training. Also, half of the respondents indicated to have a fixed annual budget for training purposes defined on yearly basis. However, several institutions have indicated that such systems are in place for legal compliance but **are a bit fluid, lack clear direction and do not necessarily reflect a results-oriented framework (competences enhancement/ upgrade)**. Only 2 institutions considered their training policy very structured with clear guidelines and objectives, while 10 responded that training needs are identified in an unsystematic way and depend on individual circumstances, i.e may vary within the institution and depend on the individual managers' practice.

Also, some institutions indicated that funding for training has a lot of red tape and limitations (e.g., only nationally recognized courses are eligible) to let staff access European or even international training. This is particularly limiting in the context of a European-wide initiative like DiSSCo RI, in which training courses are often the result of cooperation among entities allocated in different European countries participating in the RI. Sometimes training offered by institutions through internal training programs are open to external participants or are widely available through projects like SYNTHESYS+, but such training modules are neither officially recognized (under formal education paths) nor certified. In practical terms this means that often training needed under DiSSCo will not necessarily be covered by training funding available in the institutions that may require it. Such circumstances will necessarily be reflected in the overall business model for the RI and supported on the provision of external training resources. Another issue to address is related to the fact that DPP partners are institutions represented by researchers whose expertise is primarily integrated in the areas of Science and Data. This statement is corroborated by the feedback provided under Q6 on training currently offered. Therefore, when addressing needs in other areas, especially the Organizational area that emerged as a priority one for training and capacity building, it is necessary to look outside of the DiSSCo-related community. University museums could provide a first steppingstone and

play a role in bridging this gap involving university departments with that specific expertise to develop partnerships and possibly to co-develop new and customized courses.

Furthermore, a third of the institutions responding to the survey lacks a budget for training staff and a fourth of them lacks a training catalogue to choose from. This present situation calls for prioritizing capacity building in the **IRL Organizational** (human resources management policies and systems as well as talent development) and requires development along two directions: 1) **enhancing systems, where existing, to make them more strategic, meaningful and results-oriented and help the overall organization to be part of DiSSCo RI**; and 2) **creating a catalogue of training courses to fill existing gaps, also leveraging the unique position of university museums that have links with other departments specialized in disciplines which are not the area of expertise of the institutions (e.g. organizational development)**.

The dimensional analysis of the survey results is presented and discussed in detail in MS5 Documentation. In the current document we are presenting the key findings which are crucial for the overall design of the Training Strategy.

## Key Findings

Several overarching remarks emerge from the analysis of the survey as reflected in the present report, requiring attention to better understand the exercise made and the initial list of training design recommendations in the concluding section of this chapter.

**Prioritized areas:** The analysis indicates a clear need to prioritize **Organizational and Data areas for capacity building and training** to foster achieving the adequate level of readiness required to participate in DiSSCo RI effectively and meaningfully. For DiSSCo to be relevant in the current landscape of needs, but also stay relevant in the future, it needs to provide training not only to cater the needs of today but also those of the future. An ambitious training programme that builds in flexibility to adapt to emerging needs will make DiSSCo the European Research Infrastructure it needs to be.

- **Multi-stage and modular competence-based programme:** At this phase of DiSSCo development, it already seems important to provide capacity building opportunities for different segments of staff (management, collection managers, and researchers at large) to foster upstream adjustments that are propaedeutic to the overall readiness of the research infrastructure. Those need to tackle global perspectives (e.g., description of DiSSCo RI and its services) as well as basic infrastructure tools (such as CMSs options, and applicable standards).

- **Localization of the Training Strategy:** Once DiSSCo becomes operational, countries with specific commitments towards the RI, or represented by several distributed small- to medium-sized NHMs, will face organizational, financial and logistic challenges that could not be solved through as many dedicated digitization units as the number of involved museums at national level. These countries will develop national hubs (following the model of National Nodes initiated in DiSSCo Preparatory phase) capable of both mediating the adoption of DiSSCo standards and structure and addressing the collections data, both in terms of the DiSSCo sharing platform(s) and the national/regional/local infrastructures. Such an organizational scheme will increase the efficiency of developing effective training activities and further implementing these locally overcoming detected barriers, such as language, cultural diversity, variety in funding sources, and others.

- **Evolving system:** Besides collecting the current training needs identified in the 5 IRLs and summarized under each of those dimensions, the DiSSCo Training Strategy should develop tools to capture, on an ongoing basis, the evolving needs of staff and institutions.

Two options are available in this regard: a) two simple tools common to all DPP partners linked (to be used) respectively during annual planning and staff annual appraisal could easily capture such needs and feed into the DiSSCo RI annual training planning; b) another possible approach, currently used by GBIF Spain for their training annual planning, is based on the publication of a large list of trainings (as the reference catalogue) and choose from them the ones that have been voted the most. These two options are not incompatible and could be complementary.

- **Provisional outcomes:** Considering the lack of progress in the adjustment of staff roles and profiles, and training systems lacking a results-oriented approach towards a competences framework, another general conclusion is that training needs emerging from this survey need to be considered as provisional in terms of institutional perceptions and require further studies and localization upon the final delivery of the DiSSCo RI. Moreover, as the overarching readiness level of the infrastructure progresses, in either one of the 5 considered dimensions, new training needs will emerge and a future training reference catalogue, resulting from the implementation of the training strategy, will gradually be expanded to capture new emerging needs.

- **Partial perspective:** To improve efficiency and effectiveness of the delivery of the training needs, Task team T2.1 worked closely with Task 8.1 focusing on the Thematic Specialization Plan, and specifically on the specialization passport of the institutions in the part related to the "Trainings" and the "Database of experts" (extracted from the CETAF Registry) to link training and expertise availability. This effort was also aligned and coordinated with the DEST endeavor in this same line. On the other hand, to keep expanding and fine-tuning the list of training needs, better adjust training delivery and consider specificities at institutional and national level in depth, the project team could organize focus groups or dedicated sessions with NNs.

Under this approach the Training Strategy will also align with the systemic nature of DiSSCo and will perfectly reflect the organic structure intended for this Research Infrastructure with centralized though limited hub and a large, widely distributed set of operational units across Europe.

## Proposed recommended actions

The following statements are the key recommendations that emerge from the analysis and further discussions held around the results of the survey launched under T2.1. The training needs detected should then be considered as a guidance to identify the first building blocks of a comprehensive and consolidated Training Strategy in terms of areas for action and priorities, in the upcoming chapters of the current deliverable.

### General Considerations

Resulting from an overarching analysis, the following recommendations may drive to better understanding of the landscape of training and capacity building needs that the DiSSCo-related community of research organizations need to consider for tooling up their staff and providing them with the skills and competences necessary for their effective, meaningful and efficient participation in DiSSCo RI.

**Recommendation G1:** *Training needs are not punctual but ongoing and they evolve due not only to changes in staff size and composition; also, because learning is an evolutive process where training of existing staff allows adding new skills and knowledge to the one acquired previously, as it is a continuous building blocks process. DiSSCo should gradually build a fully-fledged catalogue of training modules in all categories and subcategories of*

the targeted dimensions (IRLs) as a **Reference List of disciplines and themes** towards which each institution could confront their needs and establish their priorities.

**Recommendation G2:** *Training requires stable resources.* DiSSCo should further investigate the **mechanisms for funding of training in each institution and within the national context** and look at ways to overcome obstacles (for e.g., via certification and common recognition). National recognition of training is often a prerequisite to use institutional dedicated budget for staff training which can represent a form of red tape for staff to access training.

**Recommendation G3:** To effectively use and profit from the operation of DiSSCo RI, staff is required to have a *minimum set of specific competences and skills*. DiSSCo should develop a **Basic Catalogue of trainings** offered to all members, for which recognition and certification shall be developed. Collaboration with existing initiatives as DEST should be fostered to ensure tailored made offers while officially recognized.

**Recommendation G4:** *Lack of awareness of DiSSCo among the institutional staff* could significantly affect several of the IRLs, especially in the Data dimension. To overcome this situation, it is recommended to **promote appointment of at least one person per institution and/or National Node (NN)** as the training contact person (with a similar role as the Institutional Moderator for technical issues) to channel training needs, ensure fluid information and facilitate capacity building within institutions. Connection to CETAF as a possible service provider of training (via DEST) should be fostered.

**Recommendation G5:** Considering the current level of maturity (or rather lack of) or readiness in some areas such as in the Organizational one (with specific HR policies and procedures), *deriving adjustments in staff job descriptions and specifications* are envisaged and thus, **capacity building courses are needed to accompany management and speed up such adaptation processes**. This area of training/capacity building seems to be a priority since it will have critical trickle-down effects on the rest of the organization and staff. This will result in more training needs to emerge to bring staff up to speed with new tasks related to the distributed RI.

**Recommendation G6:** In relation to specific features, predominantly *language, format and targeted audience* of the DiSSCo training offer, special attention should be given to **overcoming (existing and future) barriers to access trainings**. The use of online or hybrid formats without or with low training fees will enable a wider audience (for e.g., from outside Europe) to participate, both within and outside the DiSSCo institutions. Moreover, the use of common language (English) may not hinder access to the relevant staff involved.

**Recommendation G7:** Considering the *national context in which DiSSCo RI will operate*, the **“train the trainers” approach** should be adopted as a complementary strategy for broader outreach. In that respect, NNs stand as the most adequate channel to make knowledge and competences available to all their respective consortia partners.

#### *Specific Recommendations focused on the DiSSCo targeted dimension*

##### **IRL Science (IRL-S)**

**Recommendation IRL-S1:** DiSSCo community members provide a broad portfolio of IRL Science training courses, but *training opportunities are not evenly distributed across the*

institutions. DiSSCo should take charge of organizing a **portfolio of essential training in science maturity to ensure balance across the entire consortium** in those categories that are considered prioritized, to leverage the scientific research potential of its distributed system of scientific collections.

**Recommendation IRL-S2:** DiSSCo Prepare beneficiaries have identified key immediate needs within the IRL Science category that would strengthen their readiness, especially within *data*, *citizen science* and *machine learning*. It is highly recommended that those areas of specific interest are covered with **specific training designed as tutorials** in two subsequent steps: 1) global considerations, and 2) tailor-made adaptation to specific context (country level).

### IRL Data (IRL-D)

**Recommendation IRL-D1:** *Considering the objective of massively database specimens by a large number of institutions (reaching MIDS1 level), special training needs to be developed for tackling more developed MIDS levels*, and thus achieving extended and more granular degree of specimens-related information captured in the institutional CMS.

**Recommendation IRL-D2:** A comprehensive *stable data standards* to be provided by the DiSSCO RI would allow different institutions to select and/or prioritize those that better fit and accommodate to their digitization processes and strategies. **Training for implementing those standards** would be advisable.

**Recommendation IRL-D3:** For those countries with a very “granular” distribution of their collections (i.e. with a large number of small and medium sized institutions), most of (or even all) of *digitization activities might become handled under a national hub guidance*, with centralized resources that could then drive the throughout the NN and with a TtT approach. At institutional level, **training on pre-digitization actions and basic data management** would be required.

### IRL Technology (IRL-T)

**Recommendation IRL-T1:** To ensure effectiveness of the digitization processes in general, despite the level and scope of the information contained, a *sustained Data Management System needs to be implemented at institutional level*. It is recommended to provide **capacity building courses on available software and platforms for digital collections** so that institutions that do not yet have one (or are thinking to change it) can make informed choices also based on sharing of experiences from other institutions (high priority),

**Recommendation IRL-T2:** As for a *data-driven infrastructure as DiSSCo*, it is considered instrumental to **provide training and capacity building on GDPR compliant data management**. Other **sensitive areas** (e.g location information of endangered species) should also be prioritized both at institutional and staff level (collections-related staff).

**Recommendation IRL-T3:** In an era of *technological rapid changes and developments* but equally of risks and threats in relation to even ethical use of those technologies, cybersecurity has increasingly become a priority to address. Protecting institutional data generation and management would require the **provision of (short and recurring) capacity building courses on cybersecurity** to revise the full understanding of institutions of their cybersecurity threats and protection tools and encourage peer discussion and

review. This course should be non-technical, with a mix of input from cybersecurity experts and experience sharing among partners and target senior IT staff and relevant senior organizational manager(s).

### IRL Organizational (IRL-O)

**Recommendation IRL-O1:** Following the *lack of an explicit and structured plan to address staff re-organization of institutions* to implement DiSSCo Programme, there is a clear need for **reorienting or re-training existing staff** to increase organizational readiness in the organizational dimension. However, the needs are not yet well defined, and a more detailed analysis should follow.

**Recommendation IRL-O2:** Following the above, to better *identify and consolidate the training needs assessment* and ensure it is conducted on an ongoing and thorough way, DiSSCo could **develop simple and easy to use common self-assessment tools** for annual appraisal (eg. a participatory review and assessment module) to gather training needs at individual (anonymity can be guaranteed) and institutional level to feed results into the annual training plans.

**Recommendation IRL-O3:** Owing to its nature, the DiSSCo participating community is rich in training and expertise in Science and Data, but *less in Organizational management and development*. This gap can be filled with partnerships and DiSSCo could leverage the unique position of **University museums to acquire tailor-made courses** from other departments.

**Recommendation IRL-O4:** Facing the *lack of specific legal advice*, neither internally nor externally, it might be advisable to fill this gap with e.g., **mentoring and/or benchmarking programmes** across institutions and **agreements for shared resources** at national level (since they share the same legal system).

### IRL Financial (IRL-F)

**Recommendation IRL-F1:** Because of the already *existing familiarity with requirements to meet for external projects- and/or donations-based funding*, the training needs in this area lead to the **creation of self-teaching modules on introduction to financial procedures and reporting** to funders, for those newcomers and for updating on procedures and new structures.

**Recommendation IRL-F2:** To ensure *permanent updating*, it is also recommended to promote the creation of a **space/ forum for exchange of best practice** among financial staff of different institutions with regular updates on the new funder trends and provisions.

## 05 IDENTIFICATION OF TRAINING PROVIDERS, PLATFORMS AND DELIVERY CHANNELS

### Introduction

This chapter describes the process adopted by the DiSSCo project team to identify related eLearning platforms and course providers and recommend the most suitable one to meet the specific needs of DiSSCo partners on training delivery. The methodology used for this process entails a mix of three elements:

**Desk research:** An online research was carried out to understand what is available on the market in terms of eLearning platforms and respective IT providers; in fact while the software and its updates might all be open source, in order to customize and brand them to the specific needs of the client, and also to have an ongoing technical support and backstopping (for software updates, platform hosting, troubleshooting etc.) it is in general necessary to call on an external IT company specialized on eLearning platforms. While some of those companies may provide services for various platforms others specialize on one platform only.

**Semi structured interviews:** Several institutions were selected for semi-structured interviews, including NHM-UoCrete and GBIF. The group was selected following two major criteria: a) the members of the group already use an eLearning platform and b) the members of the group are particularly involved in providing training within and outside the DiSSCo community. The combination of those two elements leads to the fulfilment of two basic requirements: to learn from direct experience of the concerned partners on using such tools; and to foster strategic alignment while avoiding the multiplication of tools that discourage uptake from trainers.

**External Consultation:** An interview/discussion was organized with an organization outside of the DiSSCo Prepare project (Vlerick Business School) that has a consolidated experience in eLearning with different audiences (Post-graduate students and professionals), and uses varied platforms for the different training needs and audiences (students, corporate training, etc.), to gain additional insight.

### eLearning platforms available

#### *What is an eLearning platform*

A Learning Management System (LMS) – also known as an eLearning platform - is a cloud-based software package that enables institutions, schools and/or universities and enterprises to deliver learning content and resources to their audience (employees, students, etc.). An eLearning platform is web- and cloud-based to facilitate 24/7 access to courses and relevant educational material. Similarly, the eLearning platform allows permanent and seamless access to instrumental components of the learning system including:

- Information about **courses available**, and for each of them, specific features such as course curricula, learning objectives, methodology and formats as well as practical information such as course dates, duration, and eventually fees;

- Access to **learning materials** for students in different formats: word documents, presentations, videos, images, links to other sources and further reading;
- Possibility to have **online/offline, hybrid** (a mix of online and offline), **virtual live or recorded** (synchronous and asynchronous) classes;
- Tools to (self-) assess learning progress;
- A **forum** where trainers and trainees can interact, have Q&A sessions, and ultimately build a virtual community of students, tutors, and professors to communicate; and
- A space for **computer-supported collaborative learning system** (CSCLS) in which learners work collaboratively to solve a problem, design a project, construct together, and share knowledge using technology as their primary means of communication.

In the most comprehensive LMSs, mainly business and work-related ones, it is also possible to find extra tools such as:

- **Skills-gap analysis**;
- **Registration** management;
- Automated **online payment** systems;
- **Certifications** and **awards** (this both in academic and Live-Long Learning (LLL) programmes);
- Succession planning roadmaps; and
- **Competency** management and profiles.

### *Scope for prioritisation*

There are many different eLearning platforms available on the market, however: 1) many offer very similar services; 2) some are more academically focused whereas others are excellent to cater for very specific corporate needs but require a lot of initial investment for tailoring the platform and the trainings; and 3) some platforms are more suitable for organization of events and short training webinars, but not for fully fledged interactive and integrated training. It could be useful to discuss two delivery scenarios in the framework of DiSSCo.

- **Online classroom experience** focusing on the use of traditional LMS
- **MOOC (Massive Open Online Courses)-type course building & delivery**

In the following sections we are exploring the best available solutions for both scenarios.

### *Training based on the Online classroom experience*

After the initial desk research of the broader landscape of eLearning platforms, the work focused on the comparison of two platforms. The criteria used to shortlist the two eLearning platforms for deeper analysis were:

- Solid **presence** on the market for several years to ensure long-term reliability of service;
- **Availability** of a European-based IT/technical support service company.
- Current **use** among key project beneficiaries to capitalize on uptake, familiarity with the platform and avoid technology fatigue.
- **User-friendliness**: considering that many future users of the platform are neither full time trainers (but rather collection managers, natural history museums staff, etc.) nor full time students (trainings are mainly short term and geared towards staff), it is very



important to minimize the "transactional" cost of the platform use (and focus users on the training content and learning process). This was considered a top criterion both when shortlisting but also selecting the most suitable platform.

## Selected eLearning platforms available

After this initial scoping two eLearning platforms were shortlisted for a deeper analysis in terms of both, their services offered and their quotations, to be able to establish final consideration for recommendation. These platforms are presented in detail in this section.

### Moodle

Moodle is one of the most widespread free online learning management systems. Established in 2001, it provides educators with an open-source solution for eLearning that is scalable, customizable and secure. It is used worldwide and has a large selection of activities available:

- Moodle may organize and display courses on the dashboard the way the client wants to facilitate viewing them all briefly and getting updated information on current tasks and messages.
- Moodle enables users to work and learn together in forums, wikis, glossaries, database activities, and much more.
- The calendar tool helps keep track of academic calendars, course deadlines and group meetings.
- It is also possible to drag and drop files from cloud storage services including MS OneDrive, Dropbox and Google Drive.
- Formatting text and adding media and images is very easy with an editor that works across all web browsers and devices.
- Notifications make it possible for users to receive automatic alerts on new assignments and deadlines, forum posts and private messages to one another.

Moodle is primarily developed in Linux using Apache, PostgreSQL/MySQL/MariaDB and PHP (sometimes known as the LAMP platform). Moodle can be installed in MacOS, Windows and Linux and Unix operating systems. It is usable on both Android, iPhone and iPad mobile devices.

#### **Major features**

**Course creation:** The content page is a building block for creating a training session in Moodle. The user needs first to create a course and then the lessons can be developed within it. Lesson creation is based on 4 set-up sections, namely general, appearance, flow control and grade.

**Multimedia resources:** Moodle has full integration of Microsoft Office 365, Google, virtual class (teams), video, documentary, etc.

**Collaborative tools:** Forum, wiki, chat and groups. It is possible to integrate O365 so all the Teams functionalities for collaboration can be used within Moodle

**Assessment & certification tools:** Quiz (many versions), assignments, Live exams, Peer assessment are the most common. Certificates can be sent automatically to participants. There also some gamification tools

**Statistics, monitoring and reporting tools:** There are different tools for monitoring the users' interactions and providing reports for Moodle. An example of a recently developed

and quite advanced tool is the MoodleMinder<sup>11</sup>. The purpose of the specific tool is to help non-expert users carry out basic data mining analyses on logs they obtained via the Moodle learning management system. The tool automatically extracts features regarding student interactions with the learning system by using their click-stream data, and analyzes these data by using the data mining libraries available in the R programming language. The tool has enabled users who do not have any expertise in data mining or programming to automatically carry out data mining analyses. The information generated by the tool could help trainers in grouping participants by their interaction levels, determining users' interaction levels, and identifying important features that impact users' performance. The data processed by the tool can also be exported for use in various other analyses.

Other features include:

- GDPR compliant
- Possibility to integrate **cloud-based video communication** app like Teams, Zoom, WebEx, GoogleMeet, Big Blue Button;
- **App** (partial feature coverage);
- Online payment is possible.

### IT Support system

Moodle main characteristics are as follows:

- **Secure**: hosted in the Cloud Azure of Microsoft (in France) 24/7
- Small software **updates** are automatic and free of charge but major ones (version update) are on ad hoc basis and entail an extra cost
- Service Level Agreement (SLA) for ticketing (responses time-based).

### What makes Moodle different from other LMS

Pros:

- A global community: +160.000 registered organizations, 100+partners, more than 220.000 users worldwide, 1700+ open-source plug-ins developed;
- Market position: Nr 1 Learning Management System in the world, 60 to 95% market share, numerous IT/companies;
- Multi language capability (+100).

Cons:

- Not very intuitive: it takes more time to learn how to use the platform and to develop course; also courses can be copied and pasted for duplication, but not completely (content needs to be moved one by one);
- A number of features rely on extra modules integration;
- Some routine or smaller updates might take place at an inconvenient time (8:00 CET)
- Crowded and less focused place: the large number of partners/developers of plug-ins is a strength but also somewhat of a weakness as plug-ins are not all functional and

---

<sup>11</sup> Akçapınar, G., Bayazit, A. (2019) MoodleMiner: Data Mining Analysis Tool for Moodle Learning Management System, Elementary Education Online, 2019; 18(1): pp. 406-415

not always updated. Also, with too much choice it can be confusing for a non-training organisation to navigate such a large range of options.

### **Moodle pricing:**

The Edunao NeoCampus pack costs the following:

- 6,000 euro (one off) fee for the setup (customization) of the Moodle platform;
- 0 euro to train staff on how to use the platform (one time, for extra trainings: 1,200 euro per training);
- 4,500 euro for the annual Edunao neoCampus licence;
- 1,050 euro (10% on every invoice) contribution fee to Moodle.

From the above, the starting cost would amount up to a total initial cost of **11,550 euro (grand total)** and an annual license fee of 4,500 euro + 10% (after the first year).

The annual Edunao neoCAMPus license fee includes (see the offer attached):

- Up to 1000 users
- Web hosting, MCO and back up
- Portal available 24/7 (99% of availability)
- Help desk support for technical issues and software update

## *Chamilo*

Chamilo LMS is a free software ELearning Platform, management of face-to-face, semi-face-to-face or virtual learning, developed with the aim of improving access to education and knowledge globally. It was founded in 2002 and is headquartered in Belgium. Despite being younger than other eLearning platforms, Chamilo is currently the 4th most popular MS Opensource in the higher education sector. Chamilo is fundamentally an LMS that runs with Apache 2.2+, MySQL 5.6+ or MariaDB 5+ and PHP 5.5+ (7.2 recommended for efficiency). Chamilo can be installed in MacOS and Windows and Linux. It supports 800 thousand registered users per instance and is usable on any mobile device, cloud/SaaS or on-premises.

### **Major features**

**Customisable:** Chamilo can be customized in two respects: 1) to have the landing and other elements adjusted to reflect the organization's brand and visual identity; and 2) to adjust the features offered with standard modules or plugins.

**Course creation** is quite intuitive, and trainers can easily drag and drop content to build courses. It also has the advantage that you can easily duplicate courses to create new "editions" of the same course (at various dates, or in different locations).

**Multimedia resources:** Chamilo supports all resource types: Documents (docx, pdf, xlsx, rtf, txt, csv, ...); Images (JPG, GIF, PNG, WEBP, BMP, PPT); Audio (WAV, MP3, OGG); Video (MP4, AVI, WEBM, FLA, ...); Enhanced reality videos (360° MP4, WEBM) & 3D Exercises (QTI, HotPotatoes, XLSX); Learning paths (SCORM 1.2).

**Collaborative tools:** Chamilo has a very broad selection of collaborative tools to choose from, including Audio recording, Forums, Chat, Wiki, Blogs, Notes and Portfolios.

**Assessment & certification tools:** Tests/exercises/exams and excellent gamification tools. Certificates can be sent automatically to participants.

**Stats, monitoring and reporting tools:** Chamilo has a dedicated dashboard/panel for admins, trainers and students and numerous tools for monitoring and reporting at all levels (platform, programmes and per course).

#### Other additional features

Some of the **new features** include:

- **GDPR support:** a series of new features that allow institutions to comply with the GDPR standards with their platform;
- **App** (partial feature coverage);
- **plug ins for payment** of courses;
- possibility to integrate a **cloud-based video communication** app like Zoom or Teams for live courses; and
- Possibility to link courses to a **competences framework for HR management**.

#### IT Support system

- Tickets based system;
- Permanent availability;
- Automatic software updates;
- High security level (Last generation SSL cipher, Non-revertible bCrypt password cipher, 24/7 monitoring);
- SLA time (Time to fix problems).

#### What makes Chamilo different from other LMS

Pros:

- **Easy to use, intuitive:** reduces the time of trainers to understand the tools and develop the courses so that they can focus on the course itself;
- **Easy way to repeat courses** (sessions): Dashboard with the list of courses off line and an easy way to put them online and multiply the editions of a given course (so to give it a specific date or location);
- Chamilo developers and support system is **based in Brussels**, so it is easy to access for DiSSCo/ CETAF.

Cons:

- Limited language capability (+30);
- The initial customization and the technical support are offered primarily by its founders (Chamilo foundation) and a smaller range of IT companies.

#### Chamilo pricing

The Chamilo PRO pack costs ca. +-5500 euro per year (all taxes included). It includes:

- Platform customization: visual identity/branding and features;
- 25gb of hard disk space;

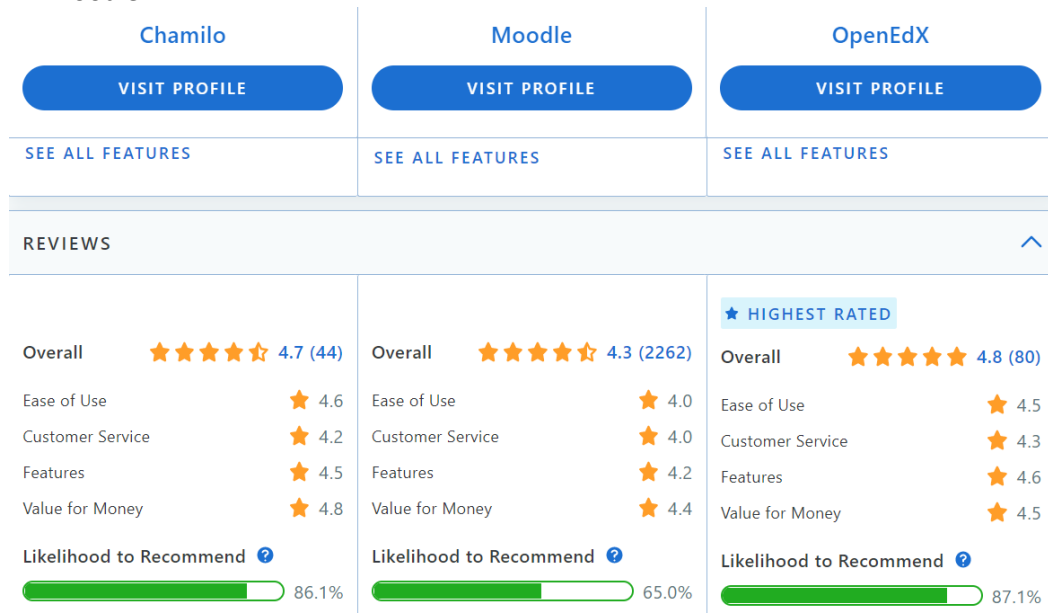
- Portal available 24/7 (99% of availability);
- Creation of up to 200 courses;
- Up to 1000 users;
- Unlimited cycles (or editions) of courses;
- A training session on how to use Chamilo;
- Help desk support (with ticket system) for technical issues and all software updates.

## Review of the selected platforms: Chamilo vs Moodle <sup>12</sup>

### Customer experience

When assessing the two solutions, reviewers find Chamilo LMS easier to use, set up, and administer. Reviewers also prefer doing business with Chamilo LMS overall.

- Reviewers feel that Chamilo LMS meets the needs of their business better than Moodle.
- When comparing the quality of ongoing product support, reviewers feel that Chamilo LMS is the preferred option.
- For feature updates and roadmaps, reviewers prefer the direction of Chamilo LMS over Moodle.



**Figure 5.1:** A comparison between Chamilo, Moodle and Open edX (see next section) based on the users' experience. Source: <https://www.capterra.com/learning-management-system-software/compare/134254-80691-162689/Chamilo-vs-Moodle-vs-OpenEdX>

### Gamification

In Chamilo gamification<sup>13</sup> is embedded in the system. Its gamification options make it easy for trainers to author interactive games, quizzes, and assignments based on lessons and skills acquired.

<sup>12</sup> <https://www.g2.com/compare/chamilo-lms-vs-moodle>

<sup>13</sup> The gamification of learning is an educational approach that seeks to motivate students by using [...] game elements in learning environment (wikipedia)

## Adaptability

Comparecamp provides an interesting comparison of the two LMS, made not in absolute terms but in relation to the specific needs of the institution (see Figure 5.2).

**What is the best learning management system for you?**

This Chamilo vs Moodle comparison article will work best for you if you're going to reflect on the following questions:

1. How many students do I intend to enroll?
2. Do I need a learning management system for educational purposes or commercial purposes?
3. What gamification tools do I need?
4. How do I want to engage my learners?
5. Do I have a definite list of built-in integrations?
6. How much knowledge do I have when it comes to coding and programming?

Chamilo is best for users in the academe as it has dedicated educational tools that allow for content-based gamification. It can take on an unlimited number of students and infinite integrations with third-party apps at absolutely no costs. Public schools and non-profit organizations will greatly benefit from its open-source nature.

Moodle is best for users that need a learning management system for commercial purposes. It's also ideal for users with no advanced knowledge when it comes to coding and programming because it has a paid version that allows for seamless customization and information dissemination without the need for complex scripting and programming. Businesses that need onboarding tools and creators that sell content will greatly benefit from its flexible and scalable learning toolsets.

**Figure 5.2:** Solutions evaluation according to the profile of the targeted user community. Source: <https://comparecamp.com/chamilo-vs-moodle-comparison/>

## Final remarks and suggested actions

Moodle is the number 1 eLearning platform in the world in terms of users and market share. Yet, Chamilo seems to be easier to use, a higher quality product with better and more attentive customer service. As the Capterra review puts it, *Moodle is an established player, while Chamilo is a noteworthy one*<sup>14</sup>.

While Moodle seems to be the platform of choice at the entry level stage, after a few years of maturity, organizations are reported to often shift to Chamilo for better performance and a follow up.

Prices for Chamilo are more competitive and with an easier pricing system with no hidden costs. This is probably because Chamilo is the developer and IT support company, so there are less middle-men and no support fee that the IT support provider must pay for the software, as in the case of Edunao - Moodle.

On top of the technical and financial considerations, there is a consideration that might be taken into consideration in relation to DiSSCo partnerships: Chamilo is used by GBIF, which is quite advanced in the organization of training and has complementarity in the type of expertise. Many trainers within the DiSSCo community also provide training within GBIF. However, systems nationally established for university education, as in Switzerland and Portugal, use Moodle which clearly facilitates the merging of existing training capacities into the new training programmes for DiSSCo.

---

<sup>14</sup> <https://www.capterra.com/learning-management-system-software/compare/134254-80691/Chamilo-vs-Moodle>

To foster cooperation, exchange of training and trainers and make trainers work in an already well-known environment, it would be preferable to use the same platform, and therefore, more in-depth research should follow to the first considerations contained in this report. It is also recommended to further **explore the usability and customer preferences** across other DPP WPs, via a joint demo session with Chamilo and Moodle.

### Training based on MOOC-type course building & delivery

For this scenario, the **Open edX platform**<sup>15</sup> provides a massively scalable learning software technology of choice for global organizations such as Microsoft and IBM. The Open edX project is run by The Centre for Reimagining Learning (tCRIL), a non-profit organization (the “NP”) that was formerly known as edX Inc. The NP is led by Harvard and MIT and will focus on inclusive learning and education. The NP will collaborate with educational institutions, governments, and other organizations to develop and evaluate new approaches to learning and pedagogy; invest in new learning models that combine the best of online and in-person; and promote the adoption of best practices across the education continuum. The NP plans to support innovation in lifelong learning and advance next generation learning experience platforms.

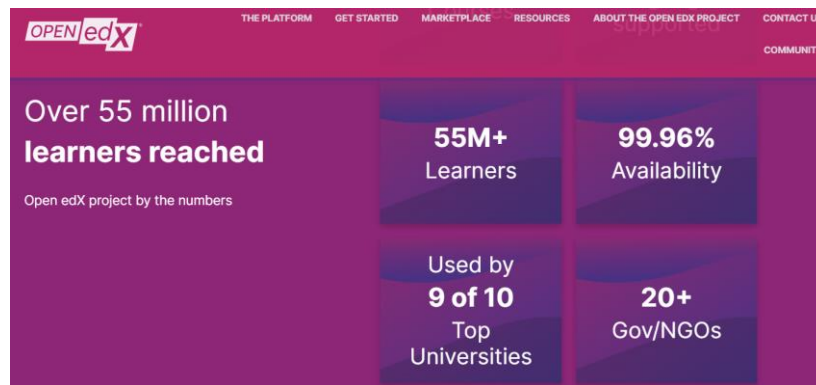


Figure 5.3: Open edX in numbers.

There are a handful of major components in the Open edX project. Where possible, these communicate using stable, documented APIs. The centerpiece of the Open edX architecture is **edx-platform**, which contains the learning management and course authoring applications (LMS and Studio, respectively). This service is supported by a collection of other autonomous web services called independently deployed applications (IDAs). Over time, edX plans to break out more of the existing edx-platform functions into new IDAs. This strategy will help manage the complexity of the edx-platform code base to make it as easy as possible for developers to approach and contribute to the project.

#### Key Components of Open edX

##### Learning Management System (LMS)

The LMS is the most visible part of the Open edX project. Learners take courses using the LMS. The LMS also provides an instructor dashboard that users who have the Admin or Staff role can access by selecting **Instructor**. The LMS uses several data stores. Courses are stored in MongoDB<sup>16</sup>, with videos served from YouTube or Amazon S3. Per-learner

<sup>15</sup> <https://openedx.org/>

<sup>16</sup> <https://www.mongodb.com/>

data is stored in MySQL. As learners move through courses and interact with them, events are published to the analytics pipeline for collection, analysis, and reporting.

### Front End

The Django server-side code in the LMS and elsewhere uses Mako<sup>17</sup> for front-end template generation. The browser-side code is written primarily in JavaScript with some CoffeeScript<sup>18</sup> as well (edX is working to replace that code with JavaScript). Parts of the client-side code use the Backbone.js<sup>19</sup> framework, and edX is moving more of the code base to use that framework. The Open edX project uses Sass<sup>20</sup> and the Bourbon framework<sup>21</sup> for CSS code.

### Course Browsing

The Open edX project provides a simple front page for browsing courses. The edx.org site has a separate home page and course discovery site that is not open source.

### Course Structure

Open edX courses are composed of units called XBlocks<sup>22</sup>. Anyone can write new XBlocks, allowing educators and technologists to extend the set of components for their courses. The edX platform also still contains several XModules, the precursors to XBlocks. EdX is working to rewrite the existing XModules as XBlocks and remove XModules from our code base.

In addition to XBlocks, there are a few ways to extend course behavior:

- The LMS is an LTI<sup>23</sup> tool consumer. Course authors can embed LTI tools to integrate other learning tools into an Open edX course.
- Problems can use embedded Python code to either present the problem or assess the learner's response. Instructor-written Python code is executed in a secure environment called CodeJail.
- JavaScript components can be integrated using JS Input<sup>24</sup>.
- Courses can be exported and imported using OLX (open learning XML), an XML-based format for courses.

### Studio

Studio is the course authoring environment. Course teams use it to create and update courses. Studio writes its courses to the same Mongo database that the LMS uses.

---

<sup>17</sup> <https://www.makotemplates.org/>

<sup>18</sup> <http://coffeescript.org/>

<sup>19</sup> <http://backbonejs.org/>

<sup>20</sup> <https://sass-lang.com/>

<sup>21</sup> <https://www.bourbon.io/>

<sup>22</sup> <https://edx.readthedocs.io/projects/xblock-tutorial/en/latest/index.html#open-edx-xblock-tutorial>

<sup>23</sup> [https://edx.readthedocs.io/projects/edx-partner-course-staff/en/latest/exercises\\_tools/Lti\\_component.html#lti-component](https://edx.readthedocs.io/projects/edx-partner-course-staff/en/latest/exercises_tools/Lti_component.html#lti-component)

<sup>24</sup> [https://edx.readthedocs.io/projects/edx-developer-guide/en/latest/extending\\_platform/javascript.html#custom-javascript-applications](https://edx.readthedocs.io/projects/edx-developer-guide/en/latest/extending_platform/javascript.html#custom-javascript-applications)



### *Discussions*

Course discussions are managed by an IDA called comments (also called forums). Comments is one of the few non-Python components, written in Ruby<sup>25</sup> using the Sinatra<sup>26</sup> framework. The LMS uses an API provided by the comments service to integrate discussions into the learners' course experience. The comments service includes a notifier process that sends learners notifications about updates in topics of interest.

### *Mobile Apps*

The Open edX project includes a mobile application, available for iOS and Android, that allows learners to watch course videos and more. EdX is actively enhancing the mobile app.

### *Analytics*

Events describing learner behavior are captured by the Open edX analytics pipeline. The events are stored as JSON in S3, processed using Hadoop, and then digested, aggregated results are published to MySQL. Results are made available via a REST API to Insights, an IDA that instructors and administrators use to explore data that lets them know what their learners are doing and how their courses are being used.

---

<sup>25</sup> <https://www.ruby-lang.org/en/>

<sup>26</sup> <https://sinatrarb.com/>

## 06 SETTING UP THE DiSSCo TRAINING STRATEGY

### Introduction

The DiSSCo Training Strategy has the ambition to design an effective **training ecosystem** for the users of the RI, **providing a learning continuum that will cover a wide range of training opportunities, from training for short-term task completion to support frameworks for long-term career development skills.** In such an ecosystem, each piece is interconnected thanks to the common approach proposed: formal and informal training opportunities, short term and long-term courses, self-paced activities, social learning and mentoring opportunities and involvement in virtual events or practical workshops with physical presence, participation to communities of practice, participation to conferences and seminars, job shadowing activities in the member organizations, participation in short term international courses and workshops.



**Figure 6.1:** *The DiSSCo Training Strategy Joint Learning Offer to the RI users will include a variety of training activities designed to help them make the best use of the DiSSCo services and help them forge their own path forward towards professional development while at the same time contributing to the digital transformation of the NHCs.*

A series of training activities (at local, regional, national and international level) are proposed to be organized, offering to DiSSCo users the most effective and engaging experiences that will make use of innovative forms of instruction (inquiry-based, project-based, game-based) and tools (e.g., access to rich NH scientific archives, virtual and remote experimentations, animations), and generally feel as active curators and contributors to the greatest digital collection of natural science. This will be expanded by offering concurrently opportunities for mobility, such as study visits, job shadowing opportunities, meetings, conferences, contests and competitions with the goal to enable the DiSSCo virtual community to become a forum for exchange of knowledge, and an information hub which will support, develop and promote:

- the development and enrichment of educational activities or events with emphasis on the use of the DiSSCo services.
- the integration and coordination of training activities between all stakeholder groups across different disciplines, regions and cultures.
- programs, events, activities, and organizations that promote and provide means and tools for natural science to collect and identify best-practices and outcomes.
- the scientific community and entities interested in natural science activities.

The DiSSCo Training Strategy is based on the Train the Trainer principle, creating a strong network of trainers, able to provide support to their local (institutional and national) communities. Additionally, diversity based on aspects such as educational resources, cultural differences and policies and regulations applicable have been considered to ensure the continuation and the sustainability of the proposed strategy. The DiSSCo Training Strategy proposes the creation of a training ecosystem based on the recommendations presented in Chapter 4 of this deliverable. According to the findings of the survey, different strategies are reflected in different training models of the DiSSCo organizations. The first “one-step”, qualitative based one relies on a more specialized internal staff. The second “multi-step”, quantitative based one promotes forthcoming outsourced digitization activities (such as citizen-science projects or newly developed machine-learning software algorithms for the automatic transcription through advanced OCR) and could reduce the investment in internal training. Based on this, the Train the Trainers approach can be foreseen with such an approach: when a multi-tasking staff oversees many different commitments, among which the digitization of specimens could be mostly supplied by other people, or by machines, focused and short training modules would be enough to tool up the team and should be preferred in respect to more structured courses. The key characteristic of the DiSSCo Training Strategy will be the adaptation of a modular approach that will offer the flexibility to individuals and organizations to form professional development and educational activities customized to their specific needs. By adopting a bottom-up approach that is described in this chapter, the DiSSCo partners, in cooperation with the emerging community of practitioners will design, create, and implement **a modular training programme** which can be adapted and localized according to the needs and expectations in different European countries. It will be based on the key features of the development of NSCs digital strategy, providing strong links to the DigiComp<sup>27</sup> and the GreenComp<sup>28</sup> frameworks and will use as reference the numerous courses already offered by the DiSSCo partners. It will be delivered using different forms and models of instruction, combining effectively onsite and online learning in formal education and continuous professional development. The courses will be implemented in a scheme that combines on-site events and workshops with self-study periods, complemented with virtual and/or remote instruction over a given period of e.g., an academic year. The training courses will allow participants to choose from those workshops and activities which allow them to best address issues that are most relevant to their own organization on a regional or national level. This chapter is proposing a strategy to achieve this ambitious aim.

---

<sup>27</sup> [https://joint-research-centre.ec.europa.eu/digcomp/digcomp-framework\\_en](https://joint-research-centre.ec.europa.eu/digcomp/digcomp-framework_en)

<sup>28</sup> Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M., GreenComp The European sustainability competence framework, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.

## Training Approach and Users Guidance

### *Assisting behavioral change: Training Participants as Change Agents in their Organizations*

Asking professionals to integrate innovative methods in their everyday practice constitutes a major behavioral change and at the same time, a significant development opportunity for them. The task at hand is to manage this change in a uniform way, allowing participants to realize the potential of the opportunity offered by the DiSSCo RI services, take ownership of their contribution and maximize the output for both the infrastructure and themselves. One of the ways to attain the goals of the proposed strategy is to treat participants as equal partners in decision making. In other words, participants must play a greater role in providing key leadership at all levels of the training process. In this approach, the **central agents of this operation are the NSCs professionals**, who head the transformation processes in their organizations. There are four basic skills relevant to effective leaders namely; (1) technical skills, (2) conceptual skills, (3) interpersonal skills, and (4) self-learning skills. The DiSSCo Training Strategy promotes four key conditions that will assist participants' behavioral change:

**A purpose to believe in:** "I will change if I believe I should". The first, and most important, condition for change is identifying a purpose to believe in. In our case, we must persuade the staff of the organization of the catalyzing role of technology in the data FAIRness (Findable, Accessible, Interoperable and Reusable data), the added value for the communities the organization serves and personal achievement through learning these important subjects. We must carefully craft a "change story", underlining the benefits that the infrastructure can offer to all the involved actors. Furthermore, we must cultivate a sense of community, making the individual feel part of a cohesive multi-national team. This sense of belonging will prove very important for motivating professionals and asking them to take the next, possibly "painful" steps, of learning new skills.

**Reinforcement systems:** "I will change if I have something to win". From a pure behavioristic point of view, changing is only possible if formal and informal conditioning mechanisms are in place. It requires the organization to be transformed into a learning community. These mechanisms can reinforce the new behavior, penalize the old one or, preferably, do both. In our case, we can use informal reinforcement patterns to make the NSCs professionals more committed to the DiSSCo vision. A brief list of such methods could include competitions, challenges, promoting the best user-generated project or activity, offering e.g., the participation in a summer professional development course as a reward.

**The skills required for change:** "I will change if I have the right skills". A change is only possible if all the involved actors have the right set of skills. In the case of the DiSSCo Training Strategy, we should make sure that the delivered training programs are designed in such a way that users acquire all the skills they will need.

**Consistent role models:** "I will change if other people change". Several "change leaders" will need to be established, acting as role models for the community of DiSSCo users. These very active and competent professionals will be a proof of concept for their colleagues that the change is indeed feasible, acceptable, and beneficial for them. To achieve that, we will have to identify the highflyers among the training participants and pay special attention to motivate, support and encourage them.

All four will specifically be addressed in each implementation phase of the DiSSCo Training Strategy. An effective training approach will provide the starting point for equipping individuals with the competences they need to act successfully as change agents, developing a language/terminology necessary to describe the dynamics of change processes, enabling them to recognize different forms of resistance and addressing it in their own context. At the same time, it will provide a common basis/experience for

“connecting” professionals across organizations, within and across national boundaries – engaging them in an ongoing exchange of experiences across organization, regions and countries.

### Understanding the Train the Trainers Model

The Train the Trainers (TtT) model is intended to engage master trainers in coaching new trainers that are less experienced in the use of DiSSCo services, or with training in general. A TtT course or workshop can build a pool of competent instructors who can then teach the material and the related processes to other people. Instead of having just one trainer who teaches a course for a long time, there are multiple trainers teaching the same course at the same time in the TtT model. This means a new participant typically gets to watch an experienced trainer teach, complete the exercises, and then practice teaching segments to other participants.

### Overall Goals of the Train the Trainers Model

The main goal of the TtT model is to prepare instructors to present information effectively, respond to participant questions, and lead activities that reinforce learning. Other goals include ensuring that trainers can:

- Direct participants to supplementary resources and reference materials.
- Lead discussions.
- Listen effectively.
- Make accurate observations.
- Help participants link the training to their jobs.

Trainer participants also learn the importance of the inquiry process, presenting a positive attitude, gesturing appropriately, and maintaining interest and dispelling confusion.

**Figure 6.2. Understanding the Train the Trainers Model**



### Specific Objectives

As a result of attending a TtT training session, participants will be able to:

1. Apply current practices in delivering training on a selected evidence-based program.
2. Deliver proven facilitative skills to promote learner engagement, reflective practice, critical thinking, and skill acquisition.
3. Show mastery in delivering key training strategies commonly used, such as brainstorming, processing/process checks, roleplays, and practice sessions.
4. Use appropriate levels of intervention when managing difficult training situations, supporting participant behavioral change towards the use of advanced technological systems.
5. Initiate a personal plan of action to strengthen their training and facilitation skill.

### TtT Components

When designing a TtT course, short or long term, it is necessary to allow enough time to ensure the effective transfer of learning. This is crucial in cases in which the participants

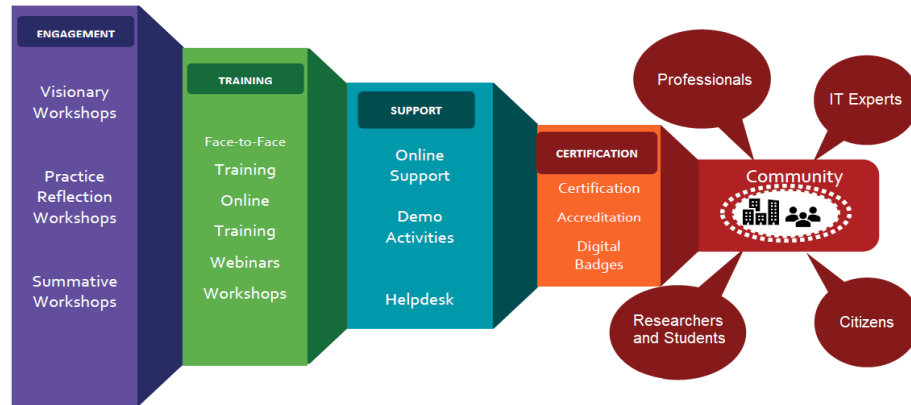
are skeptical about the introduction of innovation in their everyday practices. Consider the type and number of topics when determining how much time a training session needs, and include the following elements:

- **Pre-assessment.** It identifies pre-training knowledge, skills, and interest of the trainer participants to determine or inform the training design.
- **Pre-work.** It provides trainer participants with the knowledge and background needed before the actual TtT.
- **Co-design of the Training agenda.** The training scheme should be flexible and adapted to the specific needs of the group of the participants or the organization they are working in. This aspect will be highlighted in the following sections, where the participatory engagement scheme for DiSSCo Training Strategy will be presented in detail.
- **Facilitation manual.** A reference manual must be available to guide participants to the available services of DiSSCo.
- **Generating Creative Options by Modeling of the skills and content to be delivered.** The training must focus on bringing the practitioners together with innovators who have implemented the innovative services of DiSSCo, to generate creative options for the participants' settings. The training courses may then act as the interaction point to support the matching exercise between the identified needs from users and the best practices developed by involved actors on the use of the RI. The key outcomes of this phase will act as **ideas for the DiSSCo field trials in the participant's organization.** The quality of the ideas generated will itself be a measure of the success of the proposed approach.
- **Adult learning principles.** It provides insight into how adults learn and can help instructors be more effective in their practice and more responsive to the needs of the learners they serve.
- **Skill practice and feedback.** It provides opportunities for the practice of selected training activities or content by asking participants to present to other participants. Participants then provide feedback regarding the practice.
- **Action planning.** It takes participants through the process of creating a plan outlining the sequence of steps that must be taken or activities that must be performed well for a strategy to succeed.
- **Planned follow-up support and guidance.** It provides completed, continued and targeted follow-up support once a professional development event has been completed to strengthen the knowledge and skill level of participants. Follow-up support is intended to strengthen the transfer of learned strategies or skills so they will be retained and applied effectively.

### Community Building and Support Mechanism

DiSSCo Training Strategy must be based on an effective support framework for all stakeholders (users and providers) to facilitate their interaction with the DiSSCo services and tools. The support will be materialized in several different actions and provide innovative digitization approaches, digitization techniques, standardization and integration of collection data, capacity building opportunities and integration of digital innovation in the various levels of development, while integrating motivational mechanisms. It will also support organizations' leaders in the process of developing a digital strategy for their institutions. The vision of this task is to provide all involved stakeholders with the relevant tools and services to address the specific needs and competencies described in Chapter 4, by capitalizing on the integration of existing courses and initiatives and by developing courses and materials to cover the identified gaps. The

current chapter presents in more detail the structure that will be used to support behavioral change, to overcome barriers, to enhance achievements, to integrate new technologies in everyday practices and tasks. It must be noted that the training provision will be realized through innovative pedagogical and technical approaches to optimize the learning offer.



**Figure 6.3.** *The process for developing a strong community of the DiSSCo services.*

Supporting the digital transformation of the organization requires strategic planning, continuous reflection, deployment of innovative tools and resources and a strong component of capacity building. Stakeholders involved in the process of reinventing the numerous opportunities for the organization will need to be committed and **engaged** in the mission they are about to embark on. They will have to receive **training** and **support** to evolve in the various fronts of action. **Recognition** of their efforts should be in place as a motivational factor and finally the **whole professional and user community** should be involved to ensure the changes are consolidated and largely adopted. In the next paragraphs we will describe how the community building strategy will facilitate the TtT approach and its components.

### Engagement

The engagement activities are a key pillar for the effective involvement of the community and for the development of a change culture in the organization. DiSSCo Training Strategy wants to build trust and confidence among the training participants, by properly presenting the RI's innovative services and highlighting the new opportunities, but also by inviting the user community to be actively involved in the process of populating the digital collections or to get involved in innovative paths for exploring the NSCs. The strategy proposed involves a series of activities and workshops that are conducted either online or with physical presence. These activities will help the participants to **feel** the new context of use, the potential and the opportunities offered by the new system and, as such, build a better understanding of their needs; by jointly **imagining** solutions for detected issues and desired improvements; by supporting the **creation** of the foreseen changes, ensuring that the solutions are created with a bottom-up approach, born by the joint efforts of the staff of the organization, the technical experts, the visitors of the NSCs; and finally **sharing** with other colleagues the best practices, suggestions and lessons learnt (See Figure 6.4 – The importance of the “Change Leaders” stories).



## Case studies

### Mia Ridge, Digital Curator, Digital Research Team and Western Heritage Collections



Mia's team ensures the Library is equipped for scholars' digital needs.  
Published date: 27 September 2016

*It's a privilege to work with collect vast and varied*

I went into the Computing for Cultural Heritage course hoping to learn skills that would enable me to solve cataloguing and administrative problems, skills that would help me process data in spreadsheets more efficiently and accurately. I had one particular problem in mind and I was able to address this problem in the project module of the course. For the project we had to design a software program. I created a program (known as ReG), which automatically generates structured catalogue references for archival collections. I was extremely pleased with the outcome of this project and this piece of software is something that my team now use in our day-to-day activities. An error-prone task that could take hours or days to complete manually in Excel now takes just a few seconds and is always 100% accurate.

This in itself was a great outcome of the course that met my hopes at the outset. But this course did so much more. I came away from the course with a completely new set of data science skills that I could build on and apply in other areas. For example, I recently created another piece of software that helps my team survey any digitisation data that we receive, to help us spot any errors or problems that need fixing.

### Graham Jevon: A Digital Transformation Story

Since joining the library in 2018, the Digital Scholarship training programme has been integral to the trajectory of both my personal development and the working practices within my team.

The very first training course I attended at the library was the introduction to OpenRefine. The key thing that I took away from this course was not necessarily the skills to use the software, but simply understanding OpenRefine's functionality and the possibilities the software offered for my team. This inspired me to spend time after the session devising a workflow that enhanced our cataloguing

efficiency and accuracy, enabling me to create more detailed and accurate metadata in less time. With OpenRefine I created a semi-automated workflow that required the kind of logical thinking associated with computer programming, but without the need to understand a computer programming language.

The use of this kind of logical thinking and the introduction to writing computational expressions within OpenRefine sparked an interest in me to learn a computing language such as Python. I started a free online Python introduction, but without much context to the course my attention quickly waned. When the Digital Scholarship Computing for Cultural Heritage course was announced I therefore jumped at the chance to apply

what I learned from the Computing for Cultural Heritage course hoping to learn skills that would enable me to solve cataloguing and administrative problems, skills that would help me process data in spreadsheets more efficiently and accurately. I had one particular problem in mind and I was able to address this problem in the project module of the course. For the project we had to design a software program. I

The data science skills were particularly instrumental in enabling me to apply successfully for the British Library's Coleridge research fellowship. This research fellowship is partly a personal development scheme and it enabled me the opportunity to put my new data science skills into practice in a research environment (rather than simply using them in a cataloguing context). My previous academic research experience was based on traditional analogue methods. But for the Coleridge project I used crowdsourcing to extract data for analysis from two collections of newspapers.

The third and final Computing for Cultural Heritage module focussed on machine learning and I was able to apply these skills directly to the crowdsourcing project Agents of Enslavement. The first crowdsourcing task, for example, asked the public to draw rectangles around four specific types of newspaper advertisement. To help ensure that no adverts were missed and to account for individual errors, each image was classified by five different people. I therefore had to aggregate the results. Thanks to the new data science skills I had learned, I was able to write a Python script that used machine learning algorithms to aggregate 92,000 total rectangles drawn by the public into an aggregated dataset of 25,000 unique newspaper advertisements.

The OpenRefine and Computing for Cultural Heritage course are just two of the many digital scholarship training sessions that I have attended. But they perfectly illustrate the value of the Digital Scholarship Training Programme, which has introduced me to new software, opened my eyes to digital opportunities, provided inspiration for me to try improve, and helped me attain new skills that I have been able to put into practice both for the benefit of myself and my team.

**Figure 6.4:** The DiSSCo Training Strategy is heavily based on the contribution of the “change leaders” and their stories. Several “change leaders” will need to be established, acting as role models for the community of DiSSCo users. These highly active and competent professionals will be a proof of concept for their colleagues that the change is indeed feasible, acceptable, and beneficial for them. To achieve that we will have to identify the highflyers among the training participants and pay special attention into motivating them, supporting, and encouraging them.



The engagement and support activities are perceived as a key effort for the proposed Training Strategy. This component is completely in line with the vision of supporting the professional development and/or improvement of the digital competence profile of the DiSSCo user community. It includes several interaction activities between the DiSSCo team and the user communities.

### *Visionary Workshops*

The Visionary Workshops are the first interaction between the users and the DiSSCo RI. The Visionary Workshops are engagement activities aiming to present to potential interested users the RI and its innovative aspects, and most importantly, its benefit for the participants. This first event is not meant to present ready-made solutions for participants. It aims at starting a strong co-creation collaboration differently benefiting all members in the audience. Participants of the Visionary Workshops will be invited to dive into the realm of digital tools to enhance working experiences and learning as a transformational force that changes their organisation into a knowledge hub for their communities. During these events, potential interested parties not only receive the relevant information but can also suggest the best course of action for the integration of the RI in their own reality and context of work. From these events, the national cohort of implementers will emerge to help validate the DiSSCo RI facilities and services. They will be the co-creators of localized and tailored solutions that will eventually become adopted actions for policy creation and/or support.

Participants are introduced to the overall support framework and the existing support actions. National Nodes could localise the overall project approach, highlight the alignment of the action with national policies and discuss with participants the necessary means to support them and enhance their reach and align the NSCs organisations **vision and strategy** to better connect with the countries **digital, scientific, and educational vision and policies**. The events will also serve as a means to discuss with the organisation's leadership their plans and strategies for **involving their communities** to augment **citizens' awareness and participation**. The role of the DiSSCo RI in this process will be presented and discussed with the participants. Participants will be invited to present their **expectations**, reflect on their competence profile and their development needs. This whole process, along with the results of the self-reflection evaluation (for both organisations and users) and the recommendations for the self-development plans, will mark the first step towards the development of a feeling of ownership of the DiSSCo RI. A series of exemplary tools and resources and best practice examples will be presented to the participants. The cases that were studied in the previous chapters could offer a good reference framework for this part of the process.

### *Practice Reflection Workshops*

These workshops will focus on active users of the DiSSCo RI. Their main purpose is to **gather participants' feedback and suggestions, reflect on the overall implementation of the service and its tools** and design the **desired future for its further developments**. The users' experience will be the central focus and they should have a chance to share their success stories as well as their failures, their problems, and difficulties while they are using the system in their everyday tasks. Namely: the materialization of their digital-development plan and the feasibility of the actions contained in it, the integration of the RI services and tools in their organisation, the use of the various suggested tools and resources and the benefits perceived, the value of the use of the RI analytics framework and finally the innovative experience of interacting with their communities.

In terms of collaboration with NCs and the support received during the implementation run, participants will be invited to share their vision and perception on: their participation

in the engagement activities and training opportunities, the continuous support provided by DiSSCo team, in particular by the National Node, the added value of the use of the RI, the practical and administrative issues (i.e. communication with partners, ICT- experts, visitors), as well as the perceived impact on the organization, the professional development of the staff and the competence profile of users.

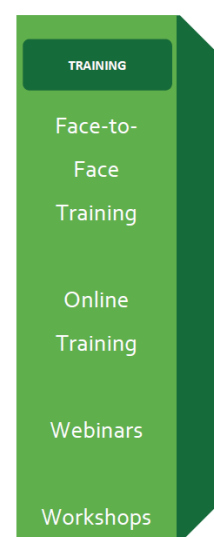
### *Summative Workshops*

The summative workshops are the events where the whole experience from the participatory process will be summarized. It is an important event especially regarding the sustainability of the project. It is important to reference the results achieved in the past events and reference the outcomes. Consequently, workshops should include general activities, such as a discussion on the positive and negative outcomes of their work with DiSSCo RI and its associated tools, the sharing of a selection of best examples and a joint reflection on do's and don'ts, a SWOT analysis performed separately by the different stakeholders groups and a final joint analysis of the major result. More specific elements can be included, such as the relevance of the development plan and the tools provided to support its materialization, the integration of the RI tools in the working environment, the concrete actions and relevant results and the value of the use of the RI Analytics Framework for the interaction with the user communities.

During the event, time should be devoted to discussing the participation in the engagement and professional development opportunities, their perception of the continuous support provided, the usefulness of the RI communication channels and a review of the practical and administrative issues (i.e., communication with partners, technical staff). Finally, an open discussion related to participants' perceived impact in the user community, in the professional development of the staff and the perceived impact on their competence profile. The community at large should be invited to participate in the event and to share their vision of the impact of the participation of the organization and/or their personal participation. This will enable a more holistic view of the impact of the various initiatives on the various sectors and actors involved in the specific actions.

### *Professional development opportunities*

The next important pillar for deployment of the DiSSCo Training Strategy is dedicated to **capacity building and training activities**. The self-reflection instruments are the first step in the journey towards improvement of capacities and skills. The pillar is composed of several initiatives: Promotion of the existing facilities within the RI infrastructure of tools and resources that can facilitate the process, organization of several online support actions and closely following the development and improvements taking place along the action. Professional development support actions can be delivered in the form of online courses, webinars or other. The online support will also be materialized in the form of guidelines to the use of the RI and on related ICT-based innovations that could facilitate the everyday work of the users. Tutorials and guidelines on relevant issues related to use of the digital tools will be available for the users. Components related to the **social and cultural environment** of the NSC organisation, how to assess it and how to address the specific needs via the use of **inclusive environment, collaborative tools**, facilitation the involvement of all relevant stakeholders of the community, etc. will also be presented as part of the support infrastructure.



### Support and Communication Strategies

The aim of this pillar is to ensure that a 24-hour open support channel is available to DiSSCo users. The effectiveness of any training activity and creation of a strong community of users require a strong support component. For many participants, the use of the DiSSCo RI will signify a very difficult step outside their comfort zone and the awareness that they are not alone may be the fact that will make a difference between implementing the available services or just being aware about their existence. The support strategy needs to be aligned with an efficient communication mechanism where members of the same community are in constant connection and aware of the existing initiatives and specific actions towards the development of the identified needs or the overcoming of important obstacles and barriers. Participants of training opportunities will feel encouraged if a series of communication possibilities are made available for them.

The effective implementation of the DiSSCo Training Strategy foresees the development of a Helpdesk facility that will provide support to the users. It will offer different communication channels:

- Online support provided centrally,
- Online and face-to-face customized support by National Nodes,
- Communication platforms and tools (Slack, Zoom, Webcast, etc.)
- Tools and resources Library (Tutorials and Guidelines)
- Communities of practice and peer to peer support (through social media channels)

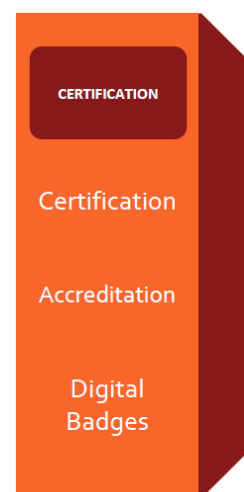


### Certification

DiSSCo Training strategy aims to enhance the interaction between NSCs in formal and informal learning environments that address a wide skill and competence. The project will develop a well-defined framework to assess training activities, programmes and resources. Based on related assessment tools, their findings and evidence, the partners will propose the outline of how such training activities can be accredited and how participating organizations need to implement such activities. This task will describe the context and the necessity of such a scheme for the support and recognition. This work will outline the concept for an accreditation scheme that can be applied based on the DiSSCo Training Strategy for activities in formal and informal settings. It will describe the context and the necessity of such a scheme, not only for the support and recognition of such training activities, but also for the support of the current educational policies for digital transformation and sustainable development at EU level.

It has to be highlighted that the efforts and the investment of both individuals and organisations towards digital transformation deserve a proper recognition and, as such, it has become an integral part of the proposed framework. The recognition can be in the form of certificates, accreditation credits, digital badges, etc. Efforts of NSCs organisations staff and other important stakeholders should also be duly recognized and highlighted.

**Recognition Activities:** For many professionals in the education field, certification and accreditation are an integral part of their professional development. With this vision in mind, it is important to investigate how to develop an efficient recognition mechanism that validates their participation and eventually recognize their support according to the



different levels of commitment. While some actions (such as the digital badges and official accreditation) need more time to be fully developed and applied, other actions such as the international contests may provide immediate recognition. The relevance of the different mechanisms varies from country to country and often from individual to individual.

**Accreditation:** For cases where the accreditation is relevant for various stakeholders, the necessary procedures will be in place to ensure that participants' efforts are recognized and duly accredited.

**DiSSCo certificates** - To materialize the acknowledgment and recognition of the everyone's support and involvement a series of certificates will be developed to recognize the various types of support and engagement.

**Digital badges** - Micro-accreditation is becoming more and more popular at an international level and regularly used as a model of building motivation among users of a specific product or solution. DiSSCo Training strategy should include a series of open badges as a reward system for the recognition of user's acquisition of specific skills. When a digital badge is issued, the receiver can display it in their digital curricula, social media, etc. This means that by clicking on the badge, the user accesses the official page where the origin and name of the owner of the badge is confirmed.

### *Community of Devoted DiSSCo Users*

The whole process described as the DiSSCo Training Strategy leads now to the final step, the fifth pillar where continuous support and sustainability can be ensured - the community building activities and sustainability efforts. The whole description, although presented in a step-by-step approach, is and should be in fact a series of cycles towards the final successful accomplishment of the established goals. The community of users generally start with the pilot stakeholders and through each implementation cycle is enriched with more participants. This desirable achievement should be foreseen from the very beginning. A properly engaged community will ensure the self-regulation and continuation of the innovation being implemented in each organization beyond the timeline of the project. Members of the community should be invited to participate at various levels; with their inputs in terms of advice, their actual engagement while implementing the project and through cycles of evaluation and changes that need to take place throughout the process. To support the emergence of this community and its self-regulation, a series of activities and channels will be created. There is no prior definition as to what channels should be used for this purpose, some "design thinking" needs to be done to ensure a wise choice of channels to be created. The strategy needs to consider the size of the target community, its social specificities, location, typology and other factors. It is important to consider what types of ICT infrastructures are in place, the level of support provided by authorities, the engagement of the different stakeholders of the community, etc. Other aspects that might be equally relevant are the attitude of the target audience toward innovation and the support they find in their community. A strong community must be self-generated or co-created by involving as many interested parties as possible. It is necessary to ensure that members of the community are properly informed and that their voices have been heard. It should be as inclusive as possible, while limiting the obstacles and barriers to its growth.

### *An example of a DiSSCo Training Course*

In this section, we are presenting a plausible DiSSCo training course. The specific course refers to the museum curators, as the envisaged DiSSCo services are expected to have

significant impact to their work. More specifically, museum curators working with DiSSCo will be able to:

- improve a museum's digital preservation, management and exploitation plan for all digital cultural content/objects, on an on-going basis
- provide information on copyright and protection of digital cultural property according to international standards
- supervise the implementation of cataloguing/archiving standards
- produce metadata according to recognised international standards
- collaborate with other museum staff in order to facilitate their work with digital cultural assets
- collaborate with other departments and manage projects involving enhancement of digital materials
- supervise the security and safety of digital materials
- design projects in collaboration with other departments to enhance the digital collection (e.g., outreach or citizen science projects and activities)
- facilitate the use of collections according to museum policies and activities.

In the following paragraphs we are presenting the structure of a course that could meet the needs of a museum curator working with DiSSCo. The structure of the course is based on the modular approach of the DiSSCo Training Strategy to allow the participants to follow their own learning path during the training experience. The course will include two main parts, the introductory part that provides basic information on the work with DiSSCo and the core part of the course that emphasizes the use of the specific DiSSCo services along with practical examples for the participants.

#### **Contents of the Introductory Course:**

The contents of the introductory course aim to help the museum curators to get familiarized with the DiSSCo services at a basic level. The aim of the course is focusing on explaining and providing evidence for the adoption of innovations in the everyday tasks of the curator. For this purpose, it includes issues and themes related to the overall digital strategy of the organization, change management and creative thinking skills. As some of the participants could already recognize the added value of the digital services in their work, they could skip this part of the course and focus only on contents related to the actual work with DiSSCo, which are indicated in bold below. It must be noted that these training modules are designed following a progressive approach, introducing the curator step by step to the use of DiSSCo services, from basic browsing and searching for data in the DiSSCo database to the creation and sharing of digital content with others and populating the DiSSCo database.

- Digital strategy alignment
- Technology trend monitoring
- Leadership and change facilitator
- Creative thinking skills
- **Browsing, searching and filtering data, information and digital content**
- **Managing data, information, and digital content in DiSSCo**
- **Evaluating data, information, and digital content**
- **Needs identification**
- **Developing digital content**
- Collaborating through digital technologies
- Team working
- **Protecting personal data and privacy**

- **ICT quality management**

In this framework we are presenting some specific examples with course structure (Knowledge domain, expected learning) that are also in line with existing training frameworks like the e-CF<sup>29</sup> and the DigiComp.

Competence title	<b>Technology trend monitoring</b>
Type	Digital (e-CF)
Description	Technology can leverage the museum experience to new levels and increase the outreach of the collection and the visitors' experience. This module focus on how the museums can monitor and adapt to the technology trends, in a way to enhance (and not overlap) the major role of the collection and the museum as a whole.
Knowledge domain	<ul style="list-style-type: none"> <li>• Existing Digital Media Technologies and future trends;</li> <li>• Games and Gamification solutions in museums;</li> <li>• Virtual, Augmented and mixed solutions in museums;</li> <li>• Usability and accessibility guidelines</li> </ul>
Learning outcomes	<ul style="list-style-type: none"> <li>• Identify at least 2 of the main milestones in the history of ICT in museums.</li> <li>• Identify at least 2 of the current technologies that will shape the future in museums.</li> <li>• Explore a SW tool to prototype a digital storytelling example.</li> <li>• Examine 3 examples of how games provide distinct experiences in museums and enhance the visitor experience, by exploring case studies.</li> <li>• List 3 advantages of how gamification can increase the visitors' engagement.</li> <li>• Describe the concept of interactive storytelling and how it expands linear storytelling, by exploring case studies.</li> <li>• Examine examples of how the reality virtuality continuum can improve the museum communication.</li> <li>• Identify 2 different types of examples of Augmented Reality applications in museums</li> <li>• Identify 2 different types of examples Virtual Reality applications in museums</li> <li>• Identify 2 different types examples of Mixed Reality applications in museums</li> <li>• Identify one set of principles of usability and how it</li> </ul>

**Figure 6.5:** Description of the Technology Trend Monitoring module of the Introductory Course (optional module)

Competence title	<b>Leadership and change facilitator</b>
Type	Transferrable / 21 <sup>st</sup> century skill
Description	Leadership skills can help us rethink the opportunities offered by digital technology to develop meaningful relationships with new and existing audiences. Why do we talk about leadership in a museum context today? How can museums lead change and innovation in ever-evolving digital society? What kind of leadership style best supports digital transformation in a museum?

**Figure 6.6:** Description of the Leadership and Change Facilitator module of the Introductory Course (optional module)

<sup>29</sup> <https://esco.ec.europa.eu/en/escopedia/european-e-competence-framework-e-cf>

Competence title	<b>Managing data, information and digital content</b>
Type	Digital (DigComp)
Description	This module facilitates attendants to organize, store and retrieve data, information and content in digital environments but also to manage and process them in a structured environment. The attendants should be able to collect, select and analyze information and use data in an optimal manner in the museum sector (i.e spreadsheet, database). Within this context, participants would improve museum's digital preservation, management and exploitation of digital content. Furthermore, they will archive and manage effectively and on time all the digital content. Data, information and digital content requires high-level ICT skills for attendants to be able to manage all the online and offline exhibitions and digital content.

**Figure 6.7:** Description of the Managing Data, Information, and digital content module of the Introductory Course (highly recommended module).

Competence title	<b>Evaluating data, information and digital content</b>
Type	Digital (DigComp)
Description	This module facilitates attendants to develop skills in order to analyze, compare and critically evaluate the credibility and reliability of sources of data, information and digital content.

**Figure 6.8:** Description of the Evaluating Data, Information, and digital content module of the Introductory Course (highly recommended module).

#### **Contents of the Core Course:**

The contents of the core course aim to help the museum curators upgrade their experience while working with DiSSCo services and make the best out of their use, while at the same time recognizing the qualitative upgrade that DiSSCo is offering to their everyday work. As in the case with the introductory course, the core course training modules are designed following a progressive approach by introducing the curator step by step to the use of DiSSCo services and beyond by proposing e.g., the expansion of the existing DiSSCo services and the design and implementation of innovative projects and activities that could facilitate the digitization process and the population of DiSSCo database (e.g., through citizen science projects that include the involvement of the citizens in the classification and tagging procedures). The core course modules will provide an in-depth presentation of the DiSSCo services:

- **Copyright and licenses in DiSSCo**
- **DiSSCo Services delivery**
- **Programming**
- **Information and knowledge management**
- **Decision making**
- **Solving technical problems in DiSSCo**
- **Risk management**

### Digitization 2.0: Charting a road map for the future

Unlike Digitization 1.0, which directly uses the physical specimen, Digitization 2.0 instead uses the digitized product from Digitization 1.0 for generating additional data and metadata (figure 1). Digitization 2.0 is powered by the online aggregation of these resources and enables digitization to assume new forms and engage vast new workforces. As we outline below, Digitization 2.0 is already well underway and holds tremendous promise. It includes semi- or fully automated data recording from digitized specimens, which stimulates research and returns value to the physical specimen. In addition, Digitization 2.0 involves an expansion in the workforce engaged in collections science. Finally, Digitization 2.0 leverages NHC resources to create trait databases, either from aggregating and better indexing existing metadata or by allowing researchers or citizen scientists to associate trait annotations with images served from NHC databases.

### Innovative tools for automating digitization: Machine learning and neural networks

Given the massive number of specimen images in digital databases with minimal data, an important first step is to better automate data transcription to augment these skeletal records. The enormity of this task is rapidly becoming impossibly large for collections staff to manage without automation. In recent years, machine learning applications utilizing convolutional neural networks have achieved stunning levels of performance in computer vision tasks including image detection and classification (Suholt and Erik 2016). Neural networks have previously demonstrated promising results for handwriting recognition systems, which could easily be applied to automated label transcription. These forms of innovative technology, which have been applied to medical diagnoses, speech recognition, and driverless cars, are now permeating NHCs (Schuettepeltz et al. 2017) and are likely to be enormously useful when trained on existing databases of handwriting samples.

Another example is to incorporate image recognition tools into digitisation processes that include imaging specimens. In this case, image recognition tools can be used on the fly to check or confirm the identifications and thus improve data quality.

**Interface for automated taxon identification**

Your search item  
ZMA.INS.1276422.1.jpg

Search

**Identification results for accession number:**  
ZMA.INS.1276422

	Graphium adonaeensis Papilionidae	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Graphium anthedon Papilionidae	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Graphium doson Papilionidae	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Save as reference

Mock-up of an interface for automated taxon identification.

Using image recognition tools to identify specimens in museum collections is likely to become common practice in the future. It is a technical tool that will enable the community to share available taxonomic expertise.

Using image recognition tools creates the possibility to identify species groups for which there is very limited to none in-house expertise. Such practices would substantially reduce costs and time spent per treated item.

**CREATING A CITIZEN SCIENCE PROJECT**

Learning Outcomes

By the end of this section, you should be able to:

- Identify different types of citizen science projects and methodology
- Suggest and structure a new citizen science project
- Deal with all different aspects of a new project: in particular data gathering and ethical issues, software and data presentation, data and metadata issues, social engagement and recruitment

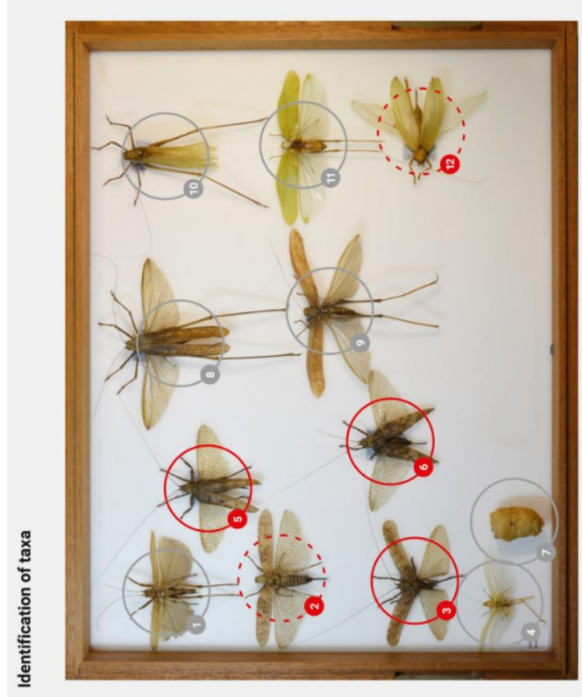
**BROWSE**

- Introduction to Research Infrastructures
- Management Challenges in Research Infrastructures
- Introduction to Collaboration in Research Infrastructures

**SHARE**

### How would this work on a daily basis for curators? We provide two examples of use cases.

First, let's zoom in to a case where a curator needs to identify a box of insects, for example bush crickets, to a lower taxonomic level. Here, he/she would take an image of the box and split it into segments of individual specimens. Then, image recognition will identify the bush crickets to a lower taxonomic level. The result, which we present in the table below – will be used to update object-level registration or to physically rearrange specimens into more accurate boxes. This entire step can also be done by non-specialist staff.



**Figure 6.9:** The core course modules will provide an in-depth presentation of the DiSSCo services. Furthermore, they will introduce the curators to innovative practices with advanced technical solutions like AI offering the opportunity to the participants to contribute and guide further DiSSCo developments. Additionally, the course will provide guidance and support for the realization of innovative projects as far as the use of the DiSSCo services are concerned, for example courses on the design of effective outreach and citizen science projects that could facilitate the demanding digitization process providing person-effort that the necessary for such a demanding task.



Furthermore, they will introduce the curators to innovative practices with advanced technical solutions like AI offering the opportunity to the participants to contribute and guide further DiSSCo developments. Additionally, the course will provide guidance and support for the realization of innovative projects as far as the use of the DiSSCo services are concerned, for example courses on the design of effective outreach and citizen science projects that could facilitate the demanding digitization process providing person-effort that the necessary for such a demanding task (see Figure 6.9).

### DiSSCo Training Assessment Portfolio

Each DiSSCo course will include an assessment kit available to both the individual participants as well as to the course provider to validate the impact of the course and its educational outcomes. Table 6.1 presents the proposed structure of the assessment portfolio that will be adopted in each course or at the level of a group of courses. It should also be noted that the assessment will be based on detailed analytics provided by the delivery platform that will be selected for use.

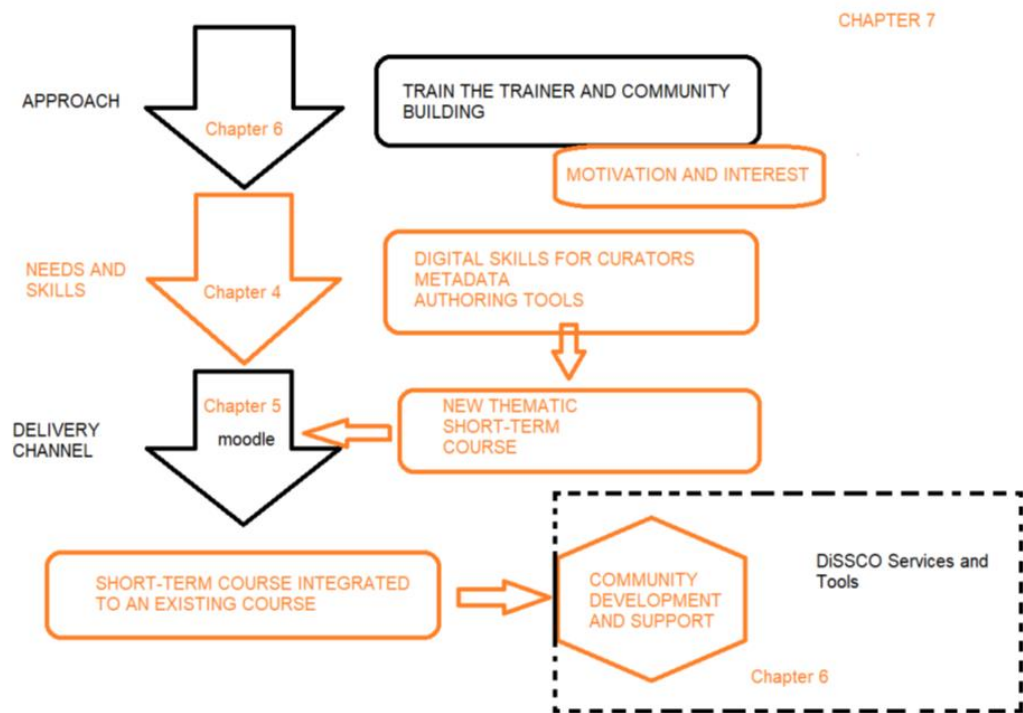
**Table 6.1: A indicative structure of the DiSSCo Assessment Portfolio**

Type of assessment	Online	Face-to-face	Work-based learning
Formative	<ol style="list-style-type: none"> <li>1. Observation (monitoring) of participants' progress by the tutor and the online platform analytics</li> <li>2. Monitoring of the participants' progress for the submission of practical assignments</li> <li>3. Informative feedback from tutors through a particular form</li> </ol>	Collaborative learning	<ol style="list-style-type: none"> <li>1. Description of tasks and activities performed (learner – supervisor)</li> <li>2. Weekly question by the social partner (optional)</li> <li>3. Bi-weekly questionnaire by the training provider</li> <li>4. On site visits</li> </ol>
Summative	Learning quizzes Practical assignments		Final presentation

## 07 DEVELOPING LOCALIZED CASE STUDIES FOR THE PARTICIPATING ORGANIZATIONS

### Introduction

Following discussions held with partners to the task T2.1, the participating institutions were asked to design and to propose a plausible scenario for the implementation of the DiSSCo Training Strategy adopted to their institutional needs and organisational structure. To do so the following key documentation was shared with the participants:



**Figure 7.1:** A graphical representation of the process was shared with the representatives of the participating institutions during the workshop providing the necessary links with the key chapters of this document. Participating organisations had to adopt the DiSSCo Training Strategy to their local settings by considering the different needs and interests of their organisations, their priorities and their overall culture of their institutions. A template was also provided to facilitate the development of the individual case studies.

- the conceptual framework, the digital strategy, the identified needs, the delivery tools and the detailed description of the Train the Trainer approach (see Chapters 2, 3, 4, 5 and 6 of this document)

- the DiSSCo Digital Maturity Self - Assessment Tool<sup>30</sup> to facilitate the process of the development of a digital strategy where DiSSCo services will be integrated and
- the list of the proposed DiSSCo services

A graphical representation (see Figure 7.1) of the process was shared with the representatives of the participating institutions during the workshop providing the necessary links with the key chapters of the document. Participating organisations had to adopt the DiSSCo Training Strategy to their local settings by considering the diverse needs and interests of their organisations, their priorities, and their overall culture of their institutions. A template was also provided to facilitate the development of the individual case studies.

In this process it was explained to the participants that an organization that plans to embark to the digital transformation journey must design a strategy including at least the following steps:

- Define a **clear plan** for the digitization of the collections
- **Identify potential risks and obstacles** in its realization
- **Identify the necessary Competencies and Skills** required for the use of DiSSCo
- **Select among the Training Offers from DiSSCo**

### Indicative case study

A Natural History Museum is developing for the digitization of their collections and the use of DiSSCo services is expected to catalyze the process. The Museum management team is setting up a strategy that will help the organization to embark to the digitization journey. These are the key steps that they are following:

#### **Step A: Define a clear plan for the digitization of the collections**

The plan includes the following actions:

- Adapting the organisation's internal structure and working model to the digital era.
- Implementing digital knowledge in as many areas and departments as possible to ensure that the digital and analogue contents are integrated and closely interlinked in a unified approach.
- Identification of existing digital assets — and assess methods used for creating and managing them — at the unit level.
- Development of the requirements for life cycle management of digital assets to ensure immediate access and long-term preservation.

Apart from the specific actions the management of the museum is convinced that it is necessary to foster a cultural change in terms of the planning and visioning of services, so that the digital element can become an integral part of the thinking and planning process from the outset. The existing processes also need to be re-examined and re-proposed in ways that are relevant in today's digital world. The DiSSCo RI will catalyze the process of the museum to find the optimal ways through which they can join forces and evaluate the feasibility of their joint endeavors, from a scientific, financial, organizational and technical perspective. With the development of digitization of NH specimens and the increasing

30

[https://know.dissco.eu/bitstream/item/158/1/DPP\\_WP3\\_MS3.2%20DiSSCo%20Digital%20Maturity%20Self%20Assessment%20Tool%20-%20Design%20Blueprint.pdf](https://know.dissco.eu/bitstream/item/158/1/DPP_WP3_MS3.2%20DiSSCo%20Digital%20Maturity%20Self%20Assessment%20Tool%20-%20Design%20Blueprint.pdf)

amount of data becoming available for digital and extended specimen information, a need for new techniques and digital skills has emerged. This is reflected by the training activities around digitization techniques, standardization and integration of collection data, and citizen science integration. The documentation has evolved from solely handwritten labels and index cards on physical specimens into suites of interconnected over time enriched data.


### **Step B: Identify the necessary Competencies and Skills required for the use of DiSSCo**

As soon as the digitization plan has been set, the Museum stakeholders have to prioritize their needs and, based on them, identify the necessary Competencies and Skills required to achieve their objectives. The focus of the museum management is on the **Organizational and Data areas for capacity building and training** to foster achieving the adequate level of readiness required to participate of DiSSCo RI effectively and meaningfully. To be relevant in the current landscape of needs, but also to stay relevant in the future, DiSSCo needs to provide training not only to cater the needs of today but also those of the future. DiSSCo Training Strategy offers a multi-stage and modular competence-based programme that could be adopted to the needs of the museum staff. In fact, the museum staff has limited technical skills and a **fast-track professional development process** must be adopted. Following an internal interactive process, the museum management sets as a priority to focus their efforts on:

- **Training for implementing** comprehensive *stable data standards* to be provided by the DiSSCo RI would allow different institutions to select and/or prioritize those that better fit and accommodate to their digitization processes and strategy.
- **Training on pre-digitization actions and basic data management processes.**

Furthermore, the museum management has identified a clear need for **re-training existing staff** to increase organizational readiness in the organizational dimension.

Training program in Entomology (special: Diptera Syrphidae), emphasis on collection management and bioindicator use  
Courses



**Description**  
The course will give an introduction to the taxonomy and the systematics of hoverflies, insects that play an important role in pollination of both crops and wild flora and are used in organic control of pests. Hoverflies are also used as bioindicators of biodiversity in natural and semi-natural ecosystems; the Spgh the list method will be explained in details. Information about other pollinators and bioindicators of biodiversity and about museum collection management will be supplied.

**Trainers**  
Carla Corazza, Civic Museum of Natural History of Ferrara. She is a biologist that since 1990 manages the Biological Research station of the Museum. She organizes taxonomy courses on terrestrial invertebrates since 1999.  
Daniela Sommeleggi, University of Bologna. He is an entomologist with a large experience in taxonomy and systematics of hoverflies and in the application of the Spgh the list method for the assessment of biodiversity. He is involved in many European projects dealing with pollinators.  
Giovanni Bergio, University of Bologna. He is a full professor of applied entomology.

**Dates of Training period**  
26-30 September 2022

**Education**  
E-learning eqvt. 40 hours

**Location**  
Ferrara, Civic Museum of Natural History and System of the Museums of the University of Ferrara, ITALY  
Protected Area of Valli Mandolitei, ITALY

**Course's language**  
English

<b>activity</b>	<b>Provide copyright information and protection of digital cultural property in accordance with international standards.</b>
<b>Hours</b>	10 – 15 hours
<b>Description</b>	Undertake the implementation and monitoring of the copyright service of the museum. Process the requests that various interested parties (researchers, schools, creative industries, artists etc.) address to the museum to use digital material. Assess and update the museum's policy on accessibility and use of collections. Make a report of the requests analysing users' profile and needs. Introduce this data in the objects' records in the Content Management System that the museum currently uses.

<b>activity</b>	<b>Produce metadata according to recognized international standards.</b>
<b>Hours</b>	10 – 15 hours
<b>Description</b>	You may be assigned to work on a specific number of objects in a collection. Contribute to the digitization and documentation of these objects according to international standards. Your work on managing digital files, producing metadata and annotating objects should also take into account museum's priorities on collection management and exhibition planning.

**Figure 7.2:** Following the participatory process for the identification of the training needs of their staff, the museum management has decided to involve their personnel in a fast-track professional development process that is based on an existing training programme for curators, enriched with additional (new) courses on implementing comprehensive stable data standards to be provided by the DiSSCO RI, and on pre-digitization actions and basic data management processes.

### **Step C: Select Among the Training Offers from DiSSCo**

In the specific case the DiSSCo Training strategy offers:

- A list of **courses and materials (guides and tutorials)** to support the individual users as well as the organization as a whole
- A series of **delivery channels** (e.g., Moodle or openEdX) to cover different training needs
- A **methodology** that is based on the Train the Trainer Approach
- **Community Building Services** to facilitate a sustainable process that will help the participants to develop further their skills after the training course.

Again, by adopting the participatory design proposed by the DiSSCo Training Strategy, the museum management decides that they will attend an existing DEST Course enriched with Short-Term Training to populate DiSSCo (see Figure 7.2). This is in line with the **fast-track professional development process** that the museum management wants to implement.

### Template for the Landscape Analysis

To facilitate the process and to coordinate the harmonization of the participating institutions, a case study template was developed and shared among the participants. A significant time-frame of two weeks was given to the participants to present their own case studies that highlight the needs of their institution and the localization of the DiSSCo Training Strategy. The template is presented in Annex 1. The template included the following focus areas:

- **Expectations of the Institution:** How will DiSSCo affect your organization? Which are the key expectations? Highlight the key axes of your organization Digital Strategy. Try to position DiSSCo in the Strategy.
- **Possible Risks and Obstacles:** Are the members of the staff ready for this change? Do they have the necessary skills? Chapter 4 (of the draft D2.1 deliverable) presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?

Based on the above, DiSSCo partners were asked to describe a scenario (using DiSSCo) that could be the reference point for the design of a training programme for their organization. They had to highlight:

- **The profile of the staff** (tasks and challenges related to the use of DiSSCo).
- **The needs of the staff.**
- **The priorities (related to the digital strategy) of the organization.**
- **The contents of the course** (If necessary, make references to existing courses offered in house or through external training providers)
- **The preferred delivery channel and time to be allocated** to such a task.
- **Optimization and localization of the Training Strategy** for my organization.

### Initial Analysis of the Partners Training Needs and Prioritization

The institutions that were involved in this initial test of the adaptability of the DiSSCo Training Strategy to their local settings were the following : The Natural History Museum at the University of Oslo (representing the institutions in Oslo, Bergen, Trondheim and Troms) that form the DiSSCo Norway consortium) (presented in Annex 4), the Natural History Museum in London (presented in Annex 5), the Natural History Museum of the University of Firenze (presented in Annex 6), the French National Museum of Natural History (presented in Annex 7) and the Natural History and Science Museum of the University of Lisbon (presented in Annex 8).

From the analysis of the information that was provided by the representatives of the abovementioned institutions, we can come to the following conclusions:

### *User Communities Expectations*

The participating institutions have numerous expectations from the operation of DiSSCo RI. The operation of the RI is expected to benefit their collections in terms of use, loans, focus and effort. The implementation of DiSSCo is in line with their digitization strategies (existing or under development). The DiSSCo infrastructure will strengthen the links with the other institutions involved and increase the valorization, access and research output on naturalist collections. On a strategic level, the implementation of the infrastructure is expected to enhance the organisations' position in relation to the national governments and Ministries in terms of leadership related to access to naturalist collections and their data for research purposes, while it will allow new collaborations and associated movements of specimens, data, and skills transfer through training. The institutions' vision is of a future where both people and planet thrive, and their mission is to create advocates for the planet. Key areas of their strategy are securing the future of their collections and transforming the study of natural history. They have clear and well-defined digitization targets in their operating plan against these areas. Digitization and wider digital transformation to increase collections access and impact with all audiences are key across this vision, mission and plan. DiSSCo is embedded in the sense that it is a catalyst and support for these aims.

Furthermore, the implementation of the DiSSCo Training Strategy is expected to offer opportunities for additional staff training, and increased collaboration beyond their countries while it will provide opportunities for data use training that are sought after by their scientific staff.

The representatives of the participating institutions agree that the RI will increase the impact of their collections data by:

- providing new opportunities for and benefits of digitization, including catalyzing national efforts; and
- providing a joined-up EU infrastructure that makes these data more accessible and powerful.
- Mass digitizing and producing a corpus of 2D and 3D digital twins. These data will be mainly associated with the digitization of collections of vertebrates, arthropods, and terrestrial and marine invertebrates over several years;
- Creating interfaces and online services associated with the data produced. This involves the specification based on the use cases identified with the users and partners of the project, of the functionalities and services of provision and data enhancement from a web interface;
- Supporting change and new shared best practices within staff involved in naturalist collections (curators, researchers, technicians...), policymakers, and open data practices.
- engaging in new DiSSCo related projects focused on scientific research, or citizen science and dissemination projects.

They also have specific expectations from specific DiSSCo Services:

- FAIR data standards for sharing their collection data in DiSSCo RI;
- Interactive specimen data annotation through SDR;

- Simplified loans and digitization on demand through ELViS (in direct alignment with modernized versions of their institutional tools, thus allowing a better workflow in requests for visits, and loans, but also associated Access activities (digitization, analysis, etc.);
- Training and capacity building through CETAF-DEST.

### Change Culture

The participating institutions are open to participation in DiSSCo RI and see it as a necessary opportunity to scale up digitization and highlight the importance of physical collections. The IRL is high in most of the cases, but the training and capacity building envisioned by DiSSCo is likely to offer plenty of opportunities for staff capacity building. A crucial issue is the time that must be allocated in the process. The staff of the participating institutions do not have enough dedicated time to get involved in long-term training courses and professional development activities. They consider as a major asset of the DiSSCo Training Strategy the fact that it integrates several processes of consultation, participation along with training and support plans to facilitate the training process. Additionally, most of the participating institutions are currently developing a variety of initiatives and projects that are focusing on the developing key skills and competencies that are presented in Chapter 4.

### Training on Innovative tools for automating digitization

Most of the institutions report thought that they struggle to recruit key technical skills such as developers and data analysts when people leave or when the work expands. For example, skills in AI (artificial intelligence) and machine learning are particularly scarce. This is owing to competition from other industries, who are able to pay a lot more for these scarce skillsets. So, bringing people on and offering training and professional development are a key part of what they should implement in order to improve this, alongside flexible working and interesting work. They also report that they sometimes struggle to hire other specialists such as project managers or communications specialists. The participating institutions are reporting that the declining number of taxonomists in the global workforce severely affects their ability to embark to the transformation journey. Combining taxonomists' expertise (past and present) with student and public training and increased automation (e.g., using AI) will facilitate enhanced specimen curation and will enable biodiversity discovery. Continued robust support for taxonomic research and training is essential according to the findings of this exercise.

#### Digitization 2.0: Charting a road map for the future

Unlike Digitization 1.0, which directly uses the physical specimen, Digitization 2.0 instead uses the digitized product from Digitization 1.0 for generating additional data and metadata (figure 1). Digitization 2.0 is powered by the online aggregation of these resources and enables digitization to assume new forms and engage vast new workforces. As we outline below, Digitization 2.0 is already well underway and holds tremendous promise. It includes semi- or fully automated data recording from digitized specimens, which stimulates research and returns value to the physical specimen. In addition, Digitization 2.0 involves an expansion in the workforce engaged in collections science. Finally, Digitization 2.0 leverages NHC resources to create trait databases, either from aggregating and better indexing existing metadata or by allowing researchers or citizen scientists to associate trait annotations with images served from NHC databases.

#### Innovative tools for automating digitization: Machine learning and neural networks

Given the massive number of specimen images in digital databases with minimal data, an important first step is to better automate data transcription to augment these skeletal records. The enormity of this task is rapidly becoming impossibly large for collections staff to manage without automation. In recent years, machine learning applications utilizing convolutional neural networks have achieved stunning levels of performance in computer vision tasks including image detection and classification (Sudholt and Fink 2016). Neural networks have previously demonstrated promising results for handwriting recognition systems, which could easily be applied to automated label transcription. These forms of innovative technology, which have been applied to medical diagnoses, speech recognition, and driverless cars, are now permeating NHCs (Schuetzpeitz et al. 2017) and are likely to be enormously useful when trained on existing databases of handwriting samples

**Figure 7.3:** *Together with the training of more expert taxonomists and organismal biologists, the widespread use of neural networks to identify specimens and target groups that need attention would enhance collection utility for research, teaching, and management, and further motivate the discovery and description of new species<sup>31</sup>.*

<sup>31</sup> Brandon P Hedrick, J Mason Heberling, Emily K Meineke, Kathryn G Turner, Christopher J Grassa, Daniel S Park, Jonathan Kennedy, Julia A Clarke, Joseph A Cook, David C Blackburn, Scott V Edwards, Charles C Davis, Digitization

### *Expansion of the digitization workforce through Citizen Science*

Expanding digitization to involve a global workforce is now possible and is stimulated by the increasingly global accessibility of NHCs. These new workforces can be developed to supplement existing organizations' staff, especially whereby new workforces further digitize specimen data (e.g., transcribing label data) from the millions of specimen images residing in databases that have limited associated metadata. One obvious group to engage in this effort is citizen scientists. NHCs associated with museums typically have departments devoted to public outreach, which can easily be tapped for aid, helping collections staff with the task of digitization while simultaneously providing the public with ownership and agency. Using citizen science in this manner has been fruitful in numerous contexts including the transcriptions of label data, georeferencing, and physical specimen annotations.

### *Training Design and Optimization of the Training Strategy*

The participating institutions consider that a two-level training should be provided to meet their expectations: 1) the first one as mean to refresh the already existing skills of the specialized staff, align with updates and new requirements and provide the trainers for the local iteration of this activity (following the train-the trainers principle); 2) the second one, starting from the more basic principles, specifically dedicated to the newly hired staff and/or fixed-term personnel engaged for special activities. The core idea develops on the principle of training pathways which could be localized to the organization needs, or even to the individual staff member needs. DiSSCo RI end users will need to understand the services that are available and how to use them. Wherever possible, this should be through communications and intuitive services, with appropriate support, as opposed to formal training. Those involved in developing the RI will generally be hired or appointed because they have the relevant skills e.g., in digitization, programme/project management, data, technology, finance etc. They may benefit from general training about the purposes and services of DiSSCo; and through schemes such as targeted DiSSCo secondments, enabling them to work effectively with colleagues in other institutions, share knowledge and skills, and to bring back to their organizations a set of upgraded skills that could benefit a better access and direct participation into the RI..

### *Focus Areas of the DiSSCo Training Strategy*

The participating institutions have a clearly expressed interest in additional training in data use, standardization, citizen science and machine learning. They also have an interest to further develop and modernize existing tools and services, acting as multi-institutional e-services in the framework of the development of DiSSCo. These developments would allow museums to make the most of their experience and propose advanced services like an ergonomic ELViS based on user stories within the DiSSCo RI. The skill requirements for such developments require training on:

- Project management, coordination, and organizing user stories;
- Web development;
- Coding and digital architecture;
- Organizing the long-term archiving of data;
- Responding to the challenges of the GDPR, while enhancing access to collection data.



We list here the main training offers that should be considered (based on the input from the participating institutions), for both the improvement of the permanent staff skills and the training of new staff members (either under permanent or fixed time contracts). Therefore, it is important to also include the skills that are expected to already be acquired by the museum staff.

For the curators:

- 1) Museology: which is the role and the way a museological collection is set and organized, which kind of information the specimens can provide, etc.
- 2) Taxonomy and nomenclature rules: principle for the formalization of systematics results, principle of priority, status of a name, typification etc. (everything which is needed for either the interpretation of a label and its translation to its digital twin).
- 3) Imaging and databasing: general structure of a database, ontology, nomenclatural standards and MIDS, resolution etc.
- 4) Regulations and legal constraints: how to ensure that each procedure and each practice complies at the same time with institutional/local/national/international rules and commitments.
- 5) Digitization planning: which are the different “values” of a specimen or a collection, which are the criteria for prioritization in a digitization plan, defining the policies for the different kinds of digitization (massive, on demand etc.).

For others (dedicated staff - different from the curators):

- 1) Financial planning and administrative management.
- 2) (advanced) Regulations and legal constraints (personnel in the legal office).
- 3) Computer science.
- 4) Communication and outreach.

### *Profile of the Staff*

In Chapter 2 of this document, we have described the landscape of the training activities that are offered by NH organizations and institutions. The analysis is mainly based on the work that has been done in the framework of the SYNTHESYS+ Deliverable NA2.3 focusing on the development of an initial catalogue of training courses offered by the participating institutions. It has analyzed courses, where the participation of experts from NH institutions is crucial. Important is also the tooling-up of the scientific community in their different areas of expertise. The courses can address the needs of different stages in the careers of the staff ranging from early-career investigators, young professionals to more experienced senior staff members. The following paragraphs summarize the staff categories, their on-job task descriptions and the challenges that the DiSSCo training activities and the overall offer must meet.

#### **Collection-oriented training activities**

**Staff:** Collection curators and Researchers, Collection managers, Collection technicians

**Tasks:** teaching the curating process and workflows: from the entrance of samples to the collection (after sampling), preparation for long-term preservation, recording in the public databases, and digitization (by imaging or other sources of specimen-related data).

**Challenges:** The staff has the necessary skills, but they do not have enough dedicated time to make all of the curation processes. Training courses should allow data production while there is already a lack of staff to do this work. New programs – such as SYNTHESYS + - are of great help to increase the production of new data and data mobilization.

#### **Digital-oriented training activities**

**Staff:** Some researchers and technicians are already involved in digitization and its technicalities. **Tasks:** There is a need for training to address both the scientific concepts and the technologies that allow them to be exploited in order to facilitate all collection-based research.

**Challenges:** Technology is evolving very rapidly, and updated knowledge is also essential. For example, new generation images and annotations could be addressed. Use of AI and neural networks techniques.

#### **Policy-oriented activities**

**Staff:** Policy Department and museum registrars.

**Tasks:** A training plan for regulations related to the management and circulation of collections to democratize them would be useful. Continuous training of users is a key point for good practices and their harmonization at the European level.

**Challenge:** Lack of skilled or available staff.

### *Training Priorities*

The participating institutions' contributions as far as the training priorities are concerned could be summarized as follows:

- Ensuring that each institution is aware of DiSSCo' purposes and principles and is able to drive the management, the digitization of its own collection, the research activity and the communication approach with DiSSCo and the international community as a background.
- Ensuring the alignment of each department within each institution with the same CMSs and the same practices, as defined with compliance to the international standards (we are still far from this, especially in most of the medium- to small-sized institutions).
- Making the DiSSCo services and facilities the easiest way to approach the daily issues and commitments, thus driving a natural shift from the old systems to the new ones, even before that a structured training offer is available.

All participating institutions have highlighted the importance of assisting behavioral change during the training programmes. Asking

The priority for MNHN is to redesign its Collection/Research information system to align its digital transformation in relation to collection data at the European level, and in accordance with open science and FAIR data. A quality officer in charge of the quality and homogeneity of data entry practices will be at the heart of the success to maintain a prominent level of data quality.

professionals to integrate innovative methods in their everyday practice constitutes a major behavioral change and, at the same time, a significant development opportunity for them. The task at hand is to manage this change in a uniform way, allowing participants to realize the potential of the opportunity offered by the DiSSCo RI services, take ownership of their contribution and maximize the output for both the infrastructure and themselves. One of the ways to attain the goals of the proposed strategy is to treat participants as equal partners in decision making. In other words, participants must play a greater role in providing key leadership at all levels of the training process. In this approach the central agents of this operation are the NSCs professionals, who head the transformation processes in their organizations.

### *Training Content*

The training content must be mainly related to the DiSSCo advanced services. Here is a summary of the training content proposed by the participating institutions:

- Best practices and workflows for digitization of different collection types (data capture and 2D imaging)
- Data quality
- Digital data management and curation
- Advanced digitization (e.g., 3D imaging and image analyses)
- A course focused on different machine learning approaches to research digital data (e.g., AI-based image feature extraction, AI-based semantic segmentation; Deep learning for identification of aberrant collections.)
- Collection management -- digital workflows to support key collections management processes such as accessions and loans
- Management of digitization projects
- Regulations related to the status of objects and their impact on studies and movements;
- Training in the use of the service for managing loans and visits to collections;
- Identification of needs for a new CMS allowing ergonomic input of specimen description fields with several points of attention: links with standards, reference systems, data quality improvement, etc.
- Change Management

### *Delivery Channels and Duration of the Activities*

Participating institutions have expressed different views as far as the delivery of the course is concerned, i.e., whether it requires physical presence or it can be offered online. The fact is that there are specific thematic courses that require physical interaction or hand-on involvement of the participants while others could be very easily offered online, offering the chance for the staff of the organization to follow their own learning pathway. Most representatives agree that they do not expect long-term courses and, in principle, the DiSSCo services must be user-friendly and easy to use.

Therefore, shorter and 'soft' training activities (e.g., webinars or 2-5 courses with physical presence) are likely to receive higher take-up and be more effective for the participating institutions. It is likely that they will provide a 'train the trainer' service for digitization and data mobilization - if elements of this, particularly tailored to smaller collections, are available through DiSSCo in future.

## 08 RECOMMENDATIONS FOR THE NEXT STEPS

This chapter concludes the work on the description of the DiSSCo Training Strategy and presents the key recommendations for its implementation in the coming years. It discusses the organizational issues, the content development strategy and the potential financial support channels. Furthermore, it sets a series of KPIs and presents several risks and their mitigation plans. The key recommendation though is the development of an integrated service for DiSSCo, the DiSSCo Training Service that will have the responsibility for the development and implementation of the DiSSCo Training Offer.

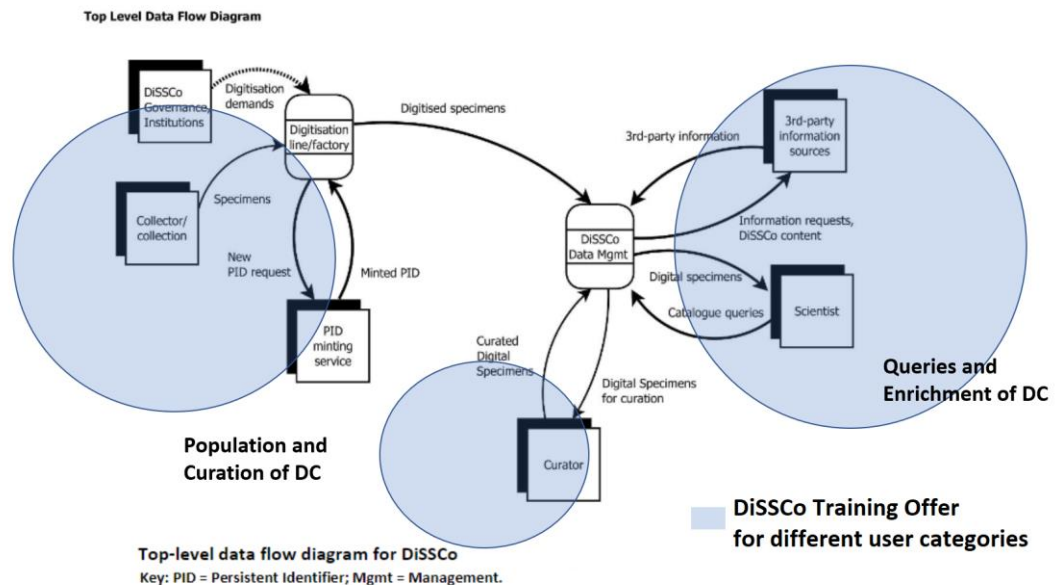
### The DiSSCo Training Service: Developing a framework for the DiSSCo Training Offer

#### *Organisation*

The aim of the DiSSCo training strategy has the ambition to design and set up an intense training ecosystem, the **DiSSCo Training Service**. In such an ecosystem, each piece is interconnected: formal and informal training opportunities, short term and long-term courses, virtual events or practical workshops with physical presence, participation in communities of practice, participation in conferences and seminars, job shadowing activities in other institutions, participation in short term summer or winter schools. No single aspect of the DiSSCo Training Service will operate in a vacuum; each activity, each aspect will rely on all other components to be effective and successful. By adopting a standard-based approach, the consortium will be able to provide a unique aggregator of training opportunities on DiSSCo services. When we define and develop each part of the training ecosystem, we will consider all interconnected parts. When we develop or adopt content, we will consider who the audience is, who will develop the content and whether they are qualified to do so, which platform will be used to distribute the content, and how the content supports the overall organizational mission and goals. Training should be tailored to the audience and be convenient for them to access upon request. Cultivating a strong training ecosystem involves thinking strategically, planning each component in concert with others. A strong ecosystem requires that educational agents (as universities and training departments of institutions) are acting as learning communities. It also involves making changes when necessary. As modern technologies and online learning systems come to market, training systems must be flexible enough to adopt new strategies. Listening to participants and evaluating training is also critical to a healthy training ecosystem. Capturing and retaining information is the difference between successful and unsuccessful training.

The key message of the DiSSCo Training Service will be that there is no single correct way to plan and implement training and professional development that is intended to improve participants' working experiences. The planning and implementation of successful professional development efforts always occur within a particular setting that presents unique goals, strengths, resources, and barriers. Effective planning and implementation of the training process require the blending of research, practitioner wisdom, passionate beliefs and a repertoire of strategies from which to choose with an emphasis always on the process of thoughtful, conscious decision-making. Seeking maximum efficiency in training NHCs organizations staff, these training programmes resort to a blended learning delivery model. This is the optimal model for professional development since it allows for flexibility without sacrificing efficiency. DiSSCo Consortium will explore how to combine

bottom-up approaches from NHCs organizations staff and their working practices and top-down approaches to support key EU policies (e.g., EU Digital Action Plan, the EU Green Deal, the GreenComp) as well as national policies and local initiatives.



**Figure 8.1:** *The DiSSCo Training Service (the cycles indicate the focus areas of the training) will offer a variety of courses for different user communities of the DiSSCo RI. The training content will be adopted and developed to facilitate the introduction of the DiSSCo services to the users. The courses' structure will follow a progressive approach by introducing the users step by step in the use of DiSSCo services and beyond by proposing e.g., the expansion of the existing DiSSCo services and the design and implementation of innovative projects and activities that could facilitate the digitization process and the population of DiSSCo database.*

The **DiSSCo Training Service** is expected to offer:

- A evolving portfolio of courses, webinars, workshops and seminars;
- MOOCs focused on the use of specific DiSSCo services and an online marketplace with self e-learning courses;
- A digital repository of openly available teaching materials (Guidelines and methods for the introduction of digital tools and services, Guidelines and methods for the organization of effective NHCs organizations staff preparation programmes;
- An extended web-based repository with Case Studies demonstrating the DiSSCo use.
- Organization of international events, such as conferences, training courses and contests to promote the use of DiSSCo RI;
- Consultation services to policy makers for the effective integration of key areas of the EU Green Deal in the national settings.

### *Development and Financial Support*

Existing training courses and materials are expected to be enriched in the upcoming period while numerous best practices will feed the training programmes portfolios of each individual partner. A two-level training should be provided to meet the needs of the NHCs organizations staff: 1) the first one as mean to refresh the already existing skills of the specialized staff, align with updates and new requirements and provide the trainers for the local iteration of this activity (following the train-the trainers principle); 2) the second

one, starting from the more basic principles, specifically dedicated to the newly hired staff and/or fixed-term personnel engaged for special activities. The core idea develops on the principle of training pathways which could be localized to the organization needs, even to the individual staff member needs. DiSSCo RI end users will need to understand the services, what is available and how to use them. Wherever possible, this should be through communications and intuitive services, with appropriate support, as opposed to formal training. As soon as the DiSSCo services become available, the training materials that will facilitate their implementation have to be available on the DEST platform. The overall effort is expected to be supported by all partners who will also continue to offer training at their local settings.

At the core of the DiSSCo Training Service exploitation strategy is a **professional development programme focusing on the use and the expansion of the DiSSCo services and tools**. Facilitating the **DiSSCo Training Service** (best practices, guidelines, case studies, tools), the programme can support participants to introduce innovative aspects in their everyday work as well as to their institutions. The programme will be offered through the DEST Environment in the form of webinars, interactive online sessions, 2-to-5-day long courses and field visits (job shadowing), and observations in NHCs organizations all over Europe (see Figure 8.2).



**Figure 8.2:** *The DiSSCo Training Service will offer a variety of courses in different locations of Europe. Interested participants could follow courses in different countries and settings, could participate in practical sessions in labs, they can visit other museums and collections or to perform job shadowing activities, while they are part of a pan-European virtual community that exchanges practices and experiences all year-long.*

In this framework, the consortium will organize DiSSCo Training Courses specifically to allow the staff of NHCs organizations to take advantage of mobility grants and thus contribute to the validation and enrichment of the implementation materials. The training programme will include guidance and support on the preparation of the Erasmus+ application and the design of innovative Digital Action Plans for the participants' organizations. These plans are based on an integrated approach that involves the whole organization community as well as numerous external stakeholders. The expenses of the realization of these activities will be also covered from the grants that the participants

could receive from their National Agencies (using the Erasmus+ KA1 mobility grants). In this way the project resources will be complemented in a more effective way offering significant impact on museum staff and other target groups that are not directly connected with the participating institutions.

Moreover, the consortium will promote synergies among participating organizations staff as well as with external stakeholders in the educational landscape towards the formation of new partnerships and possible exploitation of Erasmus+ KA2 partnership grants towards enhancement and strengthening of the organization profiles. For the project team, the number of participants who will receive funding from the Erasmus+ programme is a key performance indicator in relation to the popularity and the acceptance of these courses.

At the initial phase of the implementation of the courses, it is recommended that the consortium communicates the organization of the courses to the museum networks and to NHCs organisations, but also through the ERASMUS+ programme channels. The project team has to provide guidance and support to users' communities in preparing KA1 staff mobility applications for participation to these courses. Our estimation is that in the first phase of implementation (Year 1) about 200 participants will receive funding from KA1 to participate in about 10 courses that will be organized by the DiSSCo Training Service, while in the second phase (Year 2) the number is expected to be increased to more than 500. During the second period a number of about 20 courses is expected to be organized. From the 3<sup>rd</sup> Year on, we expect that about 1.000 will participate in the training courses of DiSSCo Training Provider per year. These initial courses will provide feedback to the DiSSCo Training Provider coordinators to develop a valid plan for the continuation of the Provider's activities. Still the long experience of the DiSSCo Prepare partners in the organization of such training courses in the framework of DEST safeguards the validity of the proposed exploitation strategy.

**Potential Exploitation Scenario for DiSSCo Training Provider:** The consortium offers the Training Provider services to the staff of the NHC organizations. Assuming that 20-21 courses (three per country of the participating organizations in Greece, Norway, Belgium, UK, Portugal, Italy and France, to allow staff from all countries to participate in the mobility actions) with 30 participants are organized, the DiSSCo Training Service can offer training to 600 members of the staff of the NHC organizations per year. The cost of the course per person per day can be set at 80 EUR (Equal to funding by Erasmus+ KA1). The total income for the DiSSCo Training Service will be (for 6-days course) at the level of 290,000 EUR per year. These costs will allow for the consortium scheme to cover travel expenses of the trainers, to develop further training materials and resources and to maintain the DiSSCo training delivery channels.

In the framework of the delivery of an integrated proposal for the DiSSCo Training Offer, Table 8.1 presents a set of key performance indicators that could act as reference points and targets for the development of the final service.

**Table 8.1: DiSSCo Training Offer KPIs.**

Description	Target Value
Number of Training Best Practices	100 Exemplary Cases of Training Courses
Active Members of DiSSCo Communities of	200 participants Involved in Training

Practice	Activities (Year 1) 500 participants Involved in Training Activities (Year 2) 1,000 participants Involved in Training Activities (Year 3)
Number of Training Events at Local and National Level (online PD Courses, Webinars, Workshops and Seminars). The duration of the training events will vary from short courses (max 5 days) to longer interventions that will be integrated to the training programmes of the participation organizations.	20 events (Year 1)
Number of International Training Events	2 (Year 1)
Number participants to provide data for the Impact Assessment	150 (Year 1), 500 (Year 2), 1,300 (Year 3)
Training and Support Effectiveness (Participants' assessment)	>80%
Consultancy Programme Effectiveness (Participants' assessment)	>80%
Number of participants who were enrolled for the whole training duration (MOOC Users)	>80%
Increase of unique visitors on DEST Website	>100,000
Number of Dissemination Events	70
Clustering with other projects in the field (RI projects, Training projects, Green Deal Projects)	30

### Dissemination

The consortium must employ a variety of dissemination, awareness raising, as well as mainstreaming and exploitation strategies to ensure the dissemination of training activities at national, European level and beyond. Furthermore, it will provide the mechanisms for effective community building and active participation to encourage a better sharing of experiences among practitioners across Europe. To maximize dissemination and impact outcomes, key stakeholders from all necessary areas of expertise must be included in the development team. These institutions are highly reputable within their respective peer groups and thus have a significant networking and consensus building capacity. Trying to take advantage of the current situation and the urgent need for action in the field, we cannot apply traditional, costly and slow approaches in communicating and, more importantly, in the delivery of the project's recommendations and results. We need a methodology to apply **economies of speed**<sup>32</sup> together with fast, scalable and scope-oriented methods. In that context, the DiSSCo Prepare project has allowed to form an outstanding, comprehensive and collaborative group of involved parties, rooted in the CETAF community and ready to meet the demanding challenges in order to execute targeted dissemination and exploitation tasks. Dissemination has been carried out from the early stages and along the project lifetime

<sup>32</sup> <https://www.futurice.com/blog/holistic-devops-economies-of-speed>



including activities related to the target stakeholders, as well as broader community awareness. The contribution of dissemination and communication work has been especially important in the preparation of the training framework and materials where the contribution of the user communities is crucial. But it is equally relevant to outline that dissemination of training will be pivotal once the DiSSCo RI is available, when all the user communities and the key stakeholders across EU should be knowledgeable and well informed on the capacities and the resources of the RI. A detailed dissemination, awareness raising, and exploitation plan must be prepared, and it will be needed to be updated continuously.

### Certification

Upon the delivery and the integration of the DiSSCo RI and its services, the project team will develop a well-defined framework to assess training modules, courses and training resources. The assessment methodology will use tools to monitor the impact of activities towards the development of the key skills that are necessary for the effective use of DiSSCo RI and the available services. Based on the assessment tools, their findings and evidence, the partners will propose the outline of how such training courses and programmes can be accredited and how the different organizations involved need to implement such activities. At this level, the DiSSCo team will need to explore the context and the necessity of such a scheme, not only for the support and recognition of the work of the individual participants but also for the support of the development of the DiSSCo infrastructure and services. This work will outline the concept for an accreditation scheme that can be applied based on the DiSSCo training strategy for activities in formal and informal training settings. It will describe the context and the necessity of such a scheme, not only for the support and recognition of training activities, but also for the support of the current policies for sustainable development at EU level.

### Initial Risk Assessment and Mitigation Plans

A Risk Register will be used as a management tool, to appropriately manage potential risks that might eventually emerge. This register will be updated as soon as risks are identified/processed throughout the development of the DiSSCo services and the training offer. Table 8.2 presents the structure of the Risk Register, with some risks already identified and registered. Each risk is identified by its ID, and the category in terms of, *project management (PM)*, *technology (T)*, *resource (R)* and *training (TR)*. For each risk, an explanation is given for the contingency plan envisaged. All these risk factors have been plotted in terms of (i) their potential occurrence and (ii) their potential impact.

**Table 8.2: DiSSCo Training Offer Critical risks and risk management strategy**

Risk No	Description	Proposed risk-mitigation measures
PM1	Difficulties in consortium coordination ( <b>Low</b> )	The consortium has worked together in other projects, whereas partners have a high degree of complementarity. The project coordinator has great experience in bringing about collaborative projects to successful completion.
PM2	Dissemination and communication risks. Lack of communication of project results that leads to limited	Early dissemination strategy planning to identify the audiences and how to reach them. DiSSCo partners have significant presence in various disciplines. Dissemination through publications, white papers, policy briefs, workshops and

	impact <b>(Low)</b>	conferences.
<b>PM6</b>	Development schedule might be too aggressive. <b>(Medium)</b>	The project has been designed to use an iterative method, so all problems, if any, will occur quite early, and will give time to react.
<b>R1</b>	Expertise risks (e.g., a key person with a specific expertise leaves the project, delaying work plan <b>(Medium)</b>	Quality project documentation and horizontal support. Contingency plans involve rescheduling of work and training. Tight project reporting and prompt response by the Project Coordinator.
<b>T1</b>	Limited backbone infrastructure for the provision of the distance learning courses <b>(Medium)</b>	The project team has significant experience in providing ICT-based solutions. It has deep knowledge on how different connectivity options can be harmonized with the proposed solutions. High-level solutions, used by millions of users across the globe are proposed for the delivery of the training.
<b>TR1</b>	Best Practices and related tools are quite complex for participants to implement <b>(Low)</b>	The Best Practices selections will be as such to minimize this risk from the first phase of the project by mapping the needs and the available solutions. The large pool of programmes and activities that the project partners are offering in this action includes practices tested in numerous NHCs in the EU.
<b>TR2</b>	Reluctance of museum staff to engage in the courses/workshops <b>(Low)</b>	The communication and support mechanism that is foreseen and the overall offer from the action will ensure the mobilization of NHCs organizations staff to apply and to take part in the pilot activities of the project.
<b>TR3</b>	Assessment tools quite complex to be filled in <b>(Medium)</b>	Provision of guidance and support to museum staff to realize the importance of the self-reflection process and to overcome their concerns. Additional data will be provided by the system analytics to avoid overwhelming the participants.
<b>TR4</b>	The Accreditation Mechanism refers to the specific countries. Limited opportunities for adoption in other EU countries <b>(Low)</b>	The action will be implemented in different EU countries that have quite different policies and approaches. This will offer the opportunity to explore specific characteristics that could act as barriers in the process. Still, working in the field for many years, the consortium partners have realized that there were remarkable similarities between the challenges faced by different NHC communities across the EU. Some were more extreme than others, but they were in essence the same challenge. Consortium partners are convinced that they have similar solutions. The development of

		the mechanism will be based on this concept covering the needs of the NHC community in the EU.
<b>TR5</b>	<b>Future</b> pandemics create difficulties in the implementation of the Training programme. <b>(Low)</b>	The DiSSCo partners have built numerous training courses over the last three years during the COVID Pandemic. They have significant experience in implementing courses over distance and offering effective and valuable training experiences. Furthermore, the current experience of the pandemic shows that the interest of the NHC organizations has increased, and the participation rates have improved. DiSSCo Training Strategy will offer a hybrid training programme to support both training models, with physical presence and over distance.

# 09 ANNEX 1: SURVEY MASTER DOCUMENT

## Survey for the compilation of needs for skills/competences

### Background information:

This survey is administered in order to develop the DiSSCo Prepare T2.1 Milestone 5 "Recommendations on suitable training mechanisms" - which is part of Task 2.1 "Training Strategy". The overall objective of this task is "to develop a training strategy with distinct channels and modes of accessing training to address the identified needs".

Milestone 5 contributes to this goal by providing "Recommendations on suitable training mechanisms; Subtask 1 - **Compilation of needs for skills/competences**; Subtask 2 - **Identification of training platforms and providers**."

This survey builds upon the work and deliverables of Synthesys+ (S+) project and in particular the "NA2.3 Catalogue and survey of training activities", both in terms of methodology and content.

1. Methodology: this survey uses the IRLs (Infrastructure Readiness Level) categories and subcategories developed under S+ NA2.3 in order to categorise the various trainings currently provided by DiSSCo partners and to identify training gaps and needs. The IRL categories and subcategories approach will also help develop a future catalogue of training that is comprehensive but also detailed enough for organisations to select modules in order to create tailored training to address their specific training needs. A few modifications to the S+ initial list of subcategories have been made to better cater for needs in the area of organisational support services (namely legal, fund raising, marketing and procurement).

2. Content: while the present survey draws on the findings of the S+ NA2.3 Catalogue (in relation to training offer in particular), it does not represent a repetition of the exercise run previously by S+ project in two respects:

2.1 Scope: the present survey aims to gather information from a broader number of participating organisations (sent to all 30 DiSSCo project partners with a minimum target of 15 respondents) compared to the S+ NA2.3 Catalogue" survey that targeted only S+ partners (10 in total) with only a partial overlap. Furthermore, the survey will be complemented with semi-structured interviews with key DiSSCo Work Package leaders in order to cross check information on training and skills needs in relation to readiness level (i.e. in order to put in place the distributed digitised collections, specimen loans and sharing system and other aspects of the DiSSCo project).

2.2 Needs focus: the survey behind the NA 2.3 Catalogue looked into the training offered by respondent organisations. The training needs were identified on the assumption that if no training is offered in a certain area there will be a training need: while this is a reasonable assumption to make, we aim to bring the analysis one step further and have a more accurate picture on training needs in relation to IRLs. In fact, some organisations might not have immediate training needs in a certain area because they have decided to outsource certain activities (for ex. fundraising or scanning of specimens) or hire new staff that is senior/ experienced in that area and does not need immediate training beyond induction (compared to more junior staff or re-training of existing staff).

Aim of the survey: the primary objective of this survey is to identify training/skills gaps and needs in relation to the readiness level of project partners.

Therefore, the present survey focuses primarily on the skills gaps and relevant training needs in relation to the organisational and staff readiness level for the set-up of the DiSSCo Infrastructure (distributed digitised collections, but also the shared specimen loan system) in the 5 IRLs (Science, Data, IT, Organisational and Financial).

### Acronyms

DiSSCo (Distributed System of Scientific Collections)

IRL: Infrastructure Readiness Level

MIDS (Minimum Information about Digital Specimen)

S+ = Synthesys+ (an EU funded project)

WP = Work Package

N.A. = not applicable

Reference documents

(Two reference documents, namely the "survey master document" and "IRLs categories and subcategories" are linked below. We suggest that you print them in order to have an overview on them while filling out the survey and selecting 5 IRLs categories and subcategories in section 6 and 7. This will help you make a choice among various categories and subcategories, having in mind the broader picture of all the options.)

[Link here "survey master document" and "IRLs Categories and Subcategories" as 2 separate pdf document]

Instructions to respond to the survey:

- Please read the survey entirely before responding to it. It will give you an overview of the survey and where to reply to some questions best. Some information might find a better place to be shared later in the survey.

- Please consult other departments: it is really important that we gather information on the reality of our institutions with the broader audience possible; while responding to this survey we really need to make an effort to look into the skills gaps, training needs and challenges that the various departments and teams within your institution face beyond the science and data community.

- How to consult: you might want to talk to different people in each department individually before filling out the relevant sections or hold a group meeting with one person from each relevant department in order to fill out each section accurately. Choose the format you consider most appropriate for your organisation.

- Reach beyond the Science and Data community of your organisation: the training gaps and needs that we want to identify in this survey are related to the DiSSCo project that involve the collections institution as whole in all departments and services (with the exception of cleaning, ticketing, bar/restaurant, gardening, security type of services). Therefore, it is really important that, when responding to this survey you think about and reach beyond the science and data community.

- this survey is composed of 15 pages and can be saved and accessed again.

1. Name of the organisation: [open box ]

2. The institution, its staff dimension and structure

(In this section we want to gather general information about the staff size of your institution. This is because smaller museums have different sets of challenges compared to bigger ones. The figures in this section do not need to be accurate to the unit, but to give a general sense of your institution's size, staff distribution in the 5 IRL categories and level of function. For this, we have used the general EU grading system with Grade A being "Administrators" with a degree level or above, grade B being "Assistants" with high school diploma education or short degree level, Grade C all other categories, such as gardeners, cleaning people, ticketing, security etc. If staff is outsourced to an external company do NOT include them in the calculation (e.g. if security services are being outsourced to an external company, do not include them in your head count).

2.1. What is the approximate staff size of your institution (permanent and temporary/fixed term)?

Small size:  ≤100; Medium size:  101 - 250. Large size:  250-500 ; Very Large:  ≥ 500

Please specify: [open box ]

2.2. How many of these people approximately work in each of the 5 IRLs (guesstimates are sufficient):

2.2.1. Science & Data: [open box ]

- Researchers/Scientists, Engineers, Scientific managers, Assistant Engineers (Grade A): [open box ]

- Data Technicians, Scientific assistants, Scanning technicians (Grade B): [open box ]

2.2.2. Technological:

- IT managers, IT engineers, IT Architects, etc (Grade A): [open box ]

- IT Technicians (Grade B): [open box ]

2.2.3 Organisational:

- Directors, Managers (Grade A): [open box ]

- Support officers, secretaries etc (Grade B): [open box ]

- Others (eg gardeners, cleaning people, ticketing, security, etc) /Grade C; please do not include staff from outsources services): [open box ]

2.2.4 Financial:

- Finance managers, Auditors, (Grade A): [open box ]

- Accounting assistants, bookkeepers (Grade B): [open box ]

### 3 IRL specific questions

#### 3.1 Science:

3.1.1 Is the science community within your organisation aware of the DiSSCo (Distributed System of Scientific Collections) project?

Fully and regularly  In part and regularly  In part and occasionally  Not at all

3.1.2 How does your organisation envisage to structure and organise the science team to feed into the DiSSCo infrastructure?

- Create a dedicated digitised collection science team  
 Science team dealing with both physical and digital collection  
 No plans yet

Please specify/Other: [open box ]

3.1.3 In general, does your institution plans to address the needs of the distributed digitised collections by:

- Hiring new dedicated Science staff  
 Re-orienting and re-training existing Science staff  
 No plans yet

3.1.4 Has the organigramme and the job descriptions of existing Science staff being adapted in order to reflect the DiSSCo Infrastructure (virtual museum and other components)?

Yes, fully adjusted  Yes, starting to adjust  Not yet, discussing the need to adjust it  Not started yet

Please specify/Other: [open box ]

3.1.5 If yes, is there a system in place in the staff appraisal to identify training needs to adjust to the new tasks?

Yes  In part  Not really

Please specify: [open box ]

3.1.6 How do you go about specimen loans within your institution?

- There is a dedicated person/team in the organisation that supports science team/curators for loans for the procedure/administrative and logistical aspects.  
 Curators deal with loan requests from their respective collections in all aspects.

Other, (please specify): [open box ]

3.1.7 Do you have a loan policy and written guidelines on how to go about loans?

Yes, clear and structured  Some guidelines, but mainly based on curators' practice  No

3.1.8 Do you have systems in place for specimen transfers and sample shipping?

Yes, clear and structured  Yes, contract with an outside company (Outsourced)  No

3.1.9 Do you consider training is needed in this area?

Yes, to build capacity  Yes to update knowledge/capacity  No

3.1.10 Do you have a digital loan system in place?

Yes, in place  NO, but developing it  Not yet

#### 3.2 Data:

3.2.1 Has your organisation already embarked on the digitization of its collection?

- Not at all  
 Started with limited funds and equipment (piloting)  
 Moving from pilot phase to scale up  
 Developed a fully-fledged digitization strategy, plans and budget

3.2.2 What is your collection's approximate size?

[open box ]

3.2.3 Broadly speaking, what percentage of your collections has reached a MIDS (Minimum Information about Digital Specimen):

Level 1 : [open box but percentage]

Level 2 : [open box ]

Level 3 : [open box ]

Level 4 : [open box ]

Level 5 : [open box ]

3.2.4 Over the past 3-5 years, would you say that your Data team (including staff scanning specimens and entering metadata) has been:

Growing slowly but steadily  Growing significantly and fast

- Shrinking slowly but steadily  Shrinking significantly and fast

3.2.5 Over the past 3-5 years, would you say that Data team has been:

- Shifting from in house to external company  
 Shifting from external company to in house  
 Remained approximately in the same ratio

Please explain the reasons behind these trends: [open box ]

- Other (please specify): [open box ]

3.2.6 Has your organisation got plans to hire new IT staff to respond to the needs of DiSSCo (Distributed System of Scientific Collection) Infrastructure Programme?

- Yes  
 Yes but there are funding limitations  
 No, staff capacity is sufficient

### 3.3 Technological:

3.3.1 How does your organisation meet its IT needs? (choose which option best reflects your organisation's situation)

- A dedicated department within the organisation  
 A person/small team within the organisation (attached to a broader dept, ex admin)  
 An IT department/support service linked to but outside the organisations (ex. university IT dept)  
 Outsourced to an external company

3.3.2 More specifically, how are the following IT services provided?

3.3.2.1 Website hosting, maintenance and support:  In house  Outsourced  N.A.

3.3.2.2 E-mail hosting, maintenance and support:  In house  Outsourced  NA

3.3.2.3 IT network systems, cloud, server management:  In house  Outsourced  NA

3.3.2.4 Collection data entry and database management:  In house  Outsourced  NA

3.3.2.5 Website and online shop design and maintenance:  In house  Outsourced  NA

3.3.2.6 Website data entry & update (keep site & shop catalogue updated):  In house  Outsourced

NA

3.3.2.7 Cybersecurity:  In house  Outsourced  NA

Other (please specify): [open box ]

3.3.3 Over the past 3-5 years, would you say that your in house IT team has been:

- Growing slightly but steadily  Growing significantly and fast  
 Shrinking slightly but steadily  Shrinking significantly and fast

3.3.4 Over the past 3-5 years, would you say that IT services provision has been:

- Shifting from in house to external company  
 Shifting from external company to in house  
 Remained in the same ratio

- No change, since outsourcing is the main strategy

Please explain the reasons behind these trends: [open box ]

3.3.5 Has your organisation got plans to hire new IT staff to respond to the needs of DiSSCo (Distributed System of Scientific Collection) Infrastructure Programme?

- Yes  
 Yes but there are funding limitations  
 No, staff capacity is sufficient

### 3.4 Organisational:

3.4.1 Is management and office staff within your organisation aware of the DiSSCo (Distributed System of Scientific Collection) Infrastructure Programme?

- Fully and regularly  In part and regularly  In part and occasionally  Not at all

3.4.2 Does your organisation have an overall organisation strategy and plans in place to develop DiSSCo (Distributed System of Scientific Collection) Infrastructure Programme?

- Yes, existing and operational  Yes but at draft level  Not yet, at discussions level  Not started yet

3.4.3 Has the organigramme and the job descriptions of management staff been adapted in order to reflect the distributed digitised collection components?

- Yes, fully adjusted  Yes, starting to adjust  Not yet, discussing the need to adjust it  Not started

yet

3.4.4 How does your organisation plan to lead and manage the distributed digitised collection?

- Create a dedicated distributed digitised collection director and team
- Management (directors and managers) dealing with both physical and virtual collections
- No plans yet

3.4.5 In general, does your institution plan to address the needs of the distributed digitised collections? If yes, how? :

- Yes, hiring new dedicated Leadership and Management staff
- Yes, re-orienting/re-training existing Leadership and Management staff
- No plans yet

3.4.6 If yes, is there a system in place in the staff appraisal to identify training needs to adjust to the new tasks?

- Yes  In part  Not really

Please specify: [open box ]

3.4.7 Does your organisation have dedicated **legal service** staff?

- NO  Yes, in house  Yes, Outsourced  Mix (inhouse and outsourcing)

Please explain the reasons behind this organisational choice: [open box ]

3.4.8 Does your organisation have a **fundraising strategy**?

- Yes  Yes (draft level)  Not yet (discussion)  No

3.4.9 Does your organisation have dedicated **fundraising staff**?

- NO  NO but other staff (e.g. Science staff) deals with it  Yes, in house  Yes, Outsourced  Mix (inhouse and outsourcing)

Please explain the reasons behind this organisational choice: [open box ]

3.4.10 Does your organisation have a **marketing strategy**? (for ex. in relation to provide potential marketing of on demand digitization or trainings services)

- Yes  Yes (draft level)  Not yet (discussion)  No

Other (please specify):

Please explain the reasons behind this organisational choice: [open box ]

3.4.11 Does your organisation have dedicated **marketing staff**?

- NO  NO but other staff (eg Comms staff) deals with it  Yes, in house  Yes, Outsourced

Other (please specify):

Please explain the reasons behind this organisational choice: [open box ]

3.4.12 Does your organisation have a **procurement policy and guidelines**?

- Yes (draft level)  Not yet (discussion)  No

Other (please specify): open box

3.4.13 Does your organisation have a dedicated **procurement staff/team**?

- NO  NO but other staff (eg Admin/finance staff) deals with it  Yes, in house  Yes, Outsourced

Other (please specify):

Please explain the reasons behind this organisational choice: [open box ]

**3.5 Financial:**

3.5.1 Does your organisation receive project funding from external donors (other than core funding from the Ministry of reference and ticket/gadget sales income)?

- Yes a large part
- A small but significant part
- A marginal part

3.5.2 If yes, what are the main sources? (more than one answer possible)

- National funds
- EU funds
- Foundations
- Other (please specify):

3.5.3 Is your financial department knowledgeable with project accounting and financial reporting to donors?

- Yes very knowledgeable  Yes but moderately knowledgeable
- Limited knowledge, needs guidance from project reference person
- Not really



3.5.4 Does your finance department feel the need for training to further develop their competencies around donor funded finances? (on a scale from 1 to 5, 1 being limited interest/need and 5 very high interest/need)

1  2  3  4  5

#### 4. Talent acquisition and management

4.1 When hiring new staff or retaining existing staff, what are the main challenges facing your organisations on a scale between 1 and 5 (1 being very little challenge and 5 a very big challenge), please rate each of the options:

Lack of cross cutting skills -  1  2  3  4  5

Salaries to attract new talents -  1  2  3  4  5

Turnover (retain existing staff) -  1  2  3  4  5

4.2 Which of the 5 IRLs face the greater challenges of hiring and retention, on a scale from 1 to 5 (put them in order from 1 to 5, 1 being less challenging and 5 being the most challenging):

Science -  1  2  3  4  5

Data -  1  2  3  4  5

IT -  1  2  3  4  5

Organisational -  1  2  3  4  5

Financial -  1  2  3  4  5

#### 5. Training systems of your organisation:

(Sections 5, 6 and 7 aim to collect information on training systems and training offered in all 5 IRL areas. Therefore, when responding to them please pay particular attention to all areas and not just to science & data training).

5.1 Does your organisation have a formal training policy?

Yes  No

5.2 Is there a training manager/officer in your organisation to oversee training needs and delivery?

Yes  No

If yes, is this:

a dedicated training manager/officer;

a staff from Management /Human Resources department;

Staff with mixed tasks (eg science and training);

Other (please specify): [open box ]

5.3 Does your organisation have an induction programme for new staff?

Yes  No

5.4 If so, how well defined or structured you would consider it (in a scale from 1 to 5, 1 being fluid/ad hoc and 5 being very structured with clear guidelines and objectives)

1  2  3  4  5

5.5 Does your organisation have a set training budget dedicated to staff?

Yes  No

5.6 If yes, how is this training being funded/resourced?

a fixed annual budget defined on a yearly basis by management

as a percentage of each staff's salary

on negotiation basis

5.7 How would you describe the staff training practice of your organisation:

Systematic, compulsory and JD/performance related

Regular but not systematic, flexible, based on staff interests and desire to get training

Occasional, a la carte, on individual basis

5.8 How are training needs for staff identified?

Systematic with job appraisal

Unsystematic, depends on the individual/manager

Ad hoc

5.9 Does your organisation have a training catalogue from which you can select options for your training needs?

Yes

No, but there is a dedicated service in another department/organisation for civil servants we can draw from

No

#### 6 Trainings provided by your institution

(In this section we would like to know about training your organisation provides, internally or open to other organisations and individuals. First insert the name of the training in the box, then select one of the 5 IRLs (readiness level) categories. A list of subcategories will appear: select relevant subcategories (one or more); repeat the operation with other relevant IRL categories. It is possible that the training you provide covers more than one area. Please tick all relevant boxes as they fit best.

Once you have completed the selection for the training, you can add a new training by clicking on the button "add a new training".

If you have already taken part in the Synthesys+ project survey for NA2.3 Catalogue, you do not need to fill in this section with training you had already indicated, but you might want to update the list.

[Instructions to set this part of survey: blank box to insert the name of the training, list of 5 IRLs categories with  and drop down list with subcategories if the person clicks on the category, possibility to select more categories and subcategories, button to "add another training with the same approach"]

Training title:

Science

8 (insert here a drop off menu with the relevant subcategories each with a )

Data

8 (insert here a drop off menu with the relevant subcategories each with a )

Technological

8 (insert here a drop off menu with the relevant subcategories each with a )

Organisational

8 (insert here a drop off menu with the relevant subcategories each with a )

Financial

8 (insert here a drop off menu with the relevant subcategories each with a )

### 7. Training needs

(In this section we would like to know if there are any specific training gaps - training that are not currently offered- that have emerged in your or other departments that are needed in order to meet the challenges of the distributed virtual museum (so training needs for readiness level). Please consult the relevant departments. Use the same steps of the previous section to encode it, i.e. insert name of training, select one IRL category at a time and then click the subcategories that are relevant. It is possible to select more than one category/subcategory. It is actually quite important to highlight the cross-cutting training/skills needs; so, wherever appropriate, please add an explanation in the notes.

[Instructions to set this part of survey: SAME AS PREVIOUS SECTION. blank box to insert the name of the training, list of 5 IRLs categories with  and drop down list with subcategories if the person clicks on the category, possibility to select more categories and subcategories; button to "add another training with the same approach"]

Training title:

Science

8 (insert here a drop off menu with the relevant subcategories each with a )

Data

8 (insert here a drop off menu with the relevant subcategories each with a )

Technological

8 (insert here a drop off menu with the relevant subcategories each with a )

Organisational

8 (insert here a drop off menu with the relevant subcategories each with a )

Financial

8 (insert here a drop off menu with the relevant subcategories each with a )

## 10 ANNEX 2: IRL CATEGORIES AND SUBCATEGORIES

List of IRL categories and subcategories (included in SYNTHESYS PLUS T2.3 "Catalogue and survey of training activities")

IRLs Categories and Subcategories		
IRL	Training subcategories	Notes
<b>IRL Science</b>	<b>#S-1. Collection/sampling of specimen</b>	Collecting within a scientific framework.
	<b>#S-2. Specimen curation</b>	Knowledge required to curate NS collection.
	<b>#S-3. Museum specimen-based research</b>	All research activities based on NS collection.
	<b>#S-4 Taxonomy</b>	
	<b>#S-5. Ecology</b>	
	<b>#S-6. Biodiversity</b>	
	<b>#S-7. Geodiversity</b>	
	<b>#S-8. Evolution</b>	
	<b>#S-9. Data analysis</b>	Software skills, analytical and technical research, or data manipulation/transformation.
	<b>#S-10. Publication and outputs</b>	Publication process and outputs measuring
	<b>#S-11 Citizens science - training the trainers</b>	Use of digitisation shared tools, databases, and platforms.
	<b>#S-12. Citizens science - training citizens</b>	Use of digitisation, shared tools, databases, and platforms.
<b>IRL Data</b>	<b>#D-13. Pre-digitisation curation</b>	Accepting & accessioning specimens/objects, workflow to get them ready for digitisation (e.g., labels, proper storage room, correct names and metadata), or metadata capture and handling.
	<b>#D-14. Standardization interoperability</b>	Data processing workflows that convert the structure of disparate datasets into a common data format (e.g., data FAIRness (Findable, Accessible, Interoperable and Reusable data), specimens data refinery, or molecular standards and processes...).
	<b>#D-15. Data curation</b>	All the activities surrounding the documentation and accessibility of NS collection data.
	<b>#D-16. Digitisation</b>	All processes that enable converting a specimen/object into a digital format (technicality, standards assessment, protocols).
	<b>#D-17. Databasing</b>	Integration and management of a specimen/object and associated (meta)data in databases.
	<b>#D-18. Data sharing</b>	Dissemination through public e-portal.

<b>IRL Technological</b>	<b>#T-19. Operating</b>	Running scientific equipment (e.g., sequencing or 2D/3D imaging facilities).
	<b>#T-20. Development</b>	Conceptual design and implementation of software and digital tools (e.g., data architecture, data carpentry).
	<b>#T-21. IT data management</b>	All activities surrounding the manipulation, protection, storage, or safety of data.
	<b>#T-22. e-Monitoring</b>	Digital management services (e.g., E-service, helpdesk, mediation services): administrators and users.
<b>IRL Organisational</b>	<b>#O-23. Policy</b>	Covers all areas of legislative practices tied to both internal (e.g., collection strategy, data management, or IT strategy) and external policies (e.g., Convention on Biological Diversity, Nagoya Protocol on ABS, or any Global activity contributing to data alignment initiatives for bio-geo collections).
	<b>#O-24. Governance</b>	Legal and decisional expertise related to inter-community partnership activities and organisation (e.g., decision making, governance levels, stakeholders' engagement).
	<b>#O-25. Management</b>	Defining strategies and management plans, administering and coordinating projects & activities.
	<b>#O-26. Support services - Legal</b>	Legal expertise in relation to virtual specimen and collection sharing, intellectual property, data protection
	<b>#O-27. Support services - Fund raising</b>	Expertise related to the definition of a fundraising strategy, identification of donors, monitoring of calls and tenders, expertise on project and partners identification and proposal writing.
	<b>#O-28. Support services - Marketing</b>	Expertise on the development of a marketing strategy and/or implementation of marketing activities, including online marketing, for ex. the promotion or sale of some services such as trainings or digitization on demand
	<b>#O-29. Support services - Procurement</b>	Expertise related to buying of equipment or services abiding to relevant national or European legislation on purchasing in public sector
	<b>#O-30. Communication</b>	Expertise related to institutional, international, public, media, partnership, and internal communication.
<b>IRL Financial</b>	<b>#F-27 Financial Management (project related)</b>	Management of financial and budgetary strategy: expertise in all accounting, management, treasury, tax and financial communication functions.
	<b>#F-28. Financial procedures and standards (incl. project funding)</b>	Drawing up and monitoring project budgets, the balance of payments, payroll, equipment investments, financial reporting to donors.
	<b>#F-29. Basic information</b>	Provision of financial information on projects.

# 11 ANNEX 3: TEMPLATE FOR THE LANDSCAPE ANALYSIS

Before starting this exercise, please:

1. Have a close look at the overall strategy [presentation](#) and the [current version of the Deliverable D2.1](#) (WIP),
2. Get familiarized with the [DiSSCo Digital Maturity Self - Assessment Tool](#),
3. Make sure that you have a good understanding of the [DiSSCo e-services](#).
4. Prepare your answers in advance of completing the form (you will not be able to save your progress!) and copy/paste them below.

## 1. Expectations

Please provide a short paragraph per topic/question.

**How will the implementation of DiSSCo RI affect your organization?**

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

**Which are the key expectations from your organization in relation to the DiSSCo RI?**

**Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.**

Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.

## 2. Possible Risks and Obstacles

Please provide a short paragraph per topic/question.

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

**Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?**

### 3. Training design

Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:

#### Profile of the staff

*Tasks and possible challenges related to the use of DiSSCo*

#### Needs of the staff

#### Priorities of the Organisation

*Related to the Digital Strategy*

#### Contents of the Course

*If necessary, make references to existing courses offered in-house or through external training providers*

#### Delivery channel and time to be allocated to such a task

#### Optimization and localization of the Training Strategy for my Organisation

# 12 ANNEX 4: NHM-UIO CONTRIBUTION

## 1. Expectations

*Please provide a short paragraph per topic/question.*

**How will the implementation of DiSSCo RI affect your organization?**

The implementation of DiSSCo RI will affect our organisation in many positive ways. The institutions in Oslo, Bergen, Trondheim and Tromsø that form the DiSSCo Norway consortium have a high level of digitization, and connecting our digitized collections to the DiSSCo RI is likely to benefit our collections in terms of use, loans, focus and effort. Implementation of the training strategy will offer opportunities for additional staff training, and increased collaboration beyond Norway. In addition in term of IRL Science, the training strategy will provide opportunities for data use training that are sought after by our scientific staff.

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

**Which are the key expectations from your organization in relation to the DiSSCo RI?**

Key expectations are: FAIR data standard sharing of our collection data into DiSSCo RI; Interactive specimen data annotation through SDR; Simplified loans and digitization on demand through ELViS; Training and capacity building through CETAF-DEST.

**Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.**

The institutions within the DiSSCo Norway consortium have shared as well as different key axes in our Digital Strategy. Shared among partners is the implementation of a single DiSSCo-compatible CMS, and this is a process that is currently underway. It involves replacing the current home grown CMS. Different among partners, but key to UiO is the digitization of all collections for open access sharing of collection data. Both the former and the latter are enhanced by the DiSSCo RI. It will be critical to prioritize DiSSCo on the Norwegian Infrastructure roadmap in order to create opportunities for a Norwegian DiSSCo node. The former is underway.

*Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.*

## 2. Possible Risks and Obstacles

*Please provide a short paragraph per topic/question.*

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

One can never be ready enough, but the DiSSCo Norway partners are open to participation in DiSSCo RI, and see it as a necessary opportunity to scale up digitization and highlight the importance of physical collections. The IRL is fairly high, but the training and capacity building envisioned by DiSSCo is likely to offer plenty of opportunities for staff capacity building.

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

The IRL is fairly high, but the training and capacity building envisioned by DiSSCo is likely to offer plenty of opportunities for staff capacity building.



Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?

NHM-UiO (one of the DiSSCo Norway consortium partners) has a high level of IRL-S, IRL-D and IRL-T, but we see clear opportunities for capacity building in S, D and T, especially staff training for data supply. In terms of data use, we have a clear expressed interest in additional training in data use, citizen science and machine learning (See Chapter 4).

### 3. Training design

Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:

#### Profile of the staff

Researchers

Tasks and possible challenges related to the use of DiSSCo

#### Needs of the staff

Skills in using digitized collection data across DiSSCo collections in research

#### Priorities of the Organisation

IRL-S; Data use

Related to the Digital Strategy

#### Contents of the Course

A course could focus on different machine learning approaches to research digital data, e.g. AI-based image feature extraction, AI-based semantic segmentation; Deep learning for identification of aberrant collections.

*If necessary, make references to existing courses offered in-house or through external training providers*

#### Delivery channel and time to be allocated to such a task

In-person course; taught in English; 5-days

#### Optimization and localization of the Training Strategy for my Organisation

One week intensive course; anywhere in Europe

### Untitled

#### Name

Hugo

First

de Boer

Last

#### Institution

NHM-UiO

# 13 ANNEX 5: NHM LONDON CONTRIBUTION

## 1. Expectations

*Please provide a short paragraph per topic/question.*

**How will the implementation of DiSSCo RI affect your organization?**

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

Implementation of the DiSSCo RI will primarily affect the teams currently working with DiSSCo, particularly the Data, Digital & Informatics team in NHM Science who are responsible for digitisation (both mass and on demand/as a service); and for managing the resulting data and platforms. This team also convene the emerging DiSSCo UK node and any national programme of digitisation. We are also a large enough organisation to have Finance, legal and similar expertise available.

NHM researchers and curators may also of course be users of the new RI, we hope that this will be a relatively organic and intuitive process and take-up, but of course there will need to be comms to let them know about the DiSSCo services and what they can expect.

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

**Which are the key expectations from your organization in relation to the DiSSCo RI?**

That it will increase the impact of our collections data by:

- providing new opportunities for and benefits of digitisation, including catalysing national efforts; and
- providing a joined up EU infrastructure that makes these data more accessible and powerful.

**Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.**

At the NHM we do not have a separate digital strategy as we believe digital transformation should form part of the wider Museum strategy and operating plan. Our vision is of a future where both people and planet thrive, and our mission is to create advocates for the planet. Key areas of our strategy are securing the future of our collections and transforming the study of natural history. We have digitisation targets in our operating plan against these areas. Digitisation and wider digital transformation to increase collections access and impact with all audiences are key across this vision, mission and plan. DiSSCo is embedded in the sense that it is a catalyst and support for these aims. For the current year 2022-23 and the next few years we also have specific deliverables to do with DiSSCo for example establishing the UK Node.

*Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.*

## 2. Possible Risks and Obstacles

*Please provide a short paragraph per topic/question.*

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

Members of the key teams have been driving digital transformation institutionally, nationally and internationally for some time, and are ready. Wider staff will need some communications - they are broadly ready but overall levels of data and digital literacy would ideally be higher across the organisation (this is true with or without DiSSCo).

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

We have staff with the necessary skills but they are often individuals or few, and we struggle to recruit key technical skills such as developers and data analysts when people leave or when the work expands. Skills in AI and machine learning are particularly scarce. This is owing to competition from other industries who are able to pay a lot more for these scarce skillsets. So bringing people on and offering training and professional development are a key part of what we should offer to improve this, alongside flexible working and interesting work. We also sometimes struggle to hire other specialisms such as project managers or communications specialists.

**Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?**

All of the competencies are relevant to our organisation (with or without DiSSCo).

### 3. Training design

*Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:*

**Profile of the staff**

DiSSCo RI end users will need to understand the services, what is available and how to use them. Wherever possible, this should be through communications and intuitive services, with appropriate support, not formal training. Those involved in developing the RI will generally be hired or appointed because they have relevant skills e.g. in digitisation, programme/project management, data, technology, finance etc. They may benefit from general training about the purposes and services of DiSSCo; and through schemes such as targeted DiSSCo secondments that enable them to work effectively with colleagues in other institutions to have knowledge and skills and to deliver.

*Tasks and possible challenges related to the use of DiSSCo*

**Priorities of the Organisation**

**Needs of the staff**

see profile of the staff

**Contents of the Course**

See expectations section above.  
In order to deliver the strategy, the organisation also promotes the following behaviours/approaches: We are pioneering; we share the wonder; we act with pace; we are curious; we are ambitious; we team up.  
In staff, we look for a combination of the right skills and experience for the role with the right behaviours/approaches and continuous learning.

*Related to the Digital Strategy*

**Delivery channel and time to be allocated to such a task**

For the majority of NHM staff, we would be surprised if the DiSSCo RI required them to undertake formal training that they didn't already need or have as part of their role e.g. collections handling, pest management, digitisation etc. Therefore, shorter / 'soft' training and communication are likely to receive higher take-up and be more effective for us.  
For the wider UK Node, it is likely that we will provide a 'train the trainer' service for digitisation and data mobilisation - if elements of this, particularly tailored to smaller collections, are available through DiSSCo in future that will be great.

See other responses. We expect to continue providing our staff with key training and induction in their roles, and don't expect this to come from DiSSCo. For the wider UK, we are also likely to offer something before DiSSCo training is in place but are likely to adopt DiSSCo training e.g. in digitisation and data mobilisation if this is tailored to smaller collections.

*If necessary, make references to existing courses offered in-house or through external training providers*

**Optimization and localization of the Training Strategy for my Organisation**

See other responses.

## Untitled

**Name**

Helen

First

Hardy

Last

**Institution**

NHM London

# 14 ANNEX 6: IT-UNIFI-MSN CONTRIBUTION

## 1. Expectations

*Please provide a short paragraph per topic/question.*

**How will the implementation of DiSSCo RI affect your organization?**

At Institution level, more human resources will be dedicated to align the institution policy and practices to DiSSCo requirements; for example more man-hours of permanent employees, such as curators, will be dedicated to DiSSCo' issues, or a temporary hiring of new employees, such as a research grant, completely dedicated to this work, will be required; in this case also new economic resource need to be invested in.

At the department level the point of view of the whole collection changes, giving more importance to the digital features of the single collections, focusing on the data digitisation and improving the collection management system currently in use, for ensuring interoperability with DiSSCo services.

At the individual level, the staff work on different disciplines, with those requested for the DiSSCo alignment partially or widely out of its background; therefore, there is a need to develop new skills and competencies.

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

**Which are the key expectations from your organization in relation to the DiSSCo RI?**

Data sharing of collections, support in digitisation and interoperability of data, engagement in new DiSSCo related projects focused on scientific research, or citizen science and dissemination projects.

**Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.**

Until now, there has not been a well defined digital strategy in place: the dedicated staff has been working synergically to address different digital issues and meeting and brainstorming have been scheduled to envisage and manage the work. About data digitisation, this has been essentially driven by a "case-by-case basis" strategy (such as digitisation on demand, new accession to the collection, loans, etc.) for almost all the collections (there are few exception of fully digitised collections), but a strong effort is currently being invested to update the existing Collection management System in order to ensure the interoperability of digitised data and allow their sharing both at the national level (compliant to the commitments with the Italian Ministry of Cultural Heritage) and at the international level (toward the implementation of DiSSCo and its related facilities). Very recently, unexpected funds coming from the PNRR (our "National Plan for Recovery and Resilience") have provided new opportunities to achieve important, additional results by the end of 2025, for both our institution and the whole Italian community of NHCs, in terms of: 1) interoperability between several RI; 2) digitization plan (both massive, i.e. semi-automatic, and/or manual, but including selected collections as a whole).

*Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.*

## 2. Possible Risks and Obstacles

*Please provide a short paragraph per topic/question.*

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

Only partially. This means that several members of the staff, at least one for each of the main collections, are already working on making the data of collections in the condition to be shared with the DiSSCo community and are acquiring new competencies that will ensure a stable collaboration in the future when DiSSCo will be operational. We aim and we are starting to work in order that most of the staff (at least, the curators) will develop very soon the same, basic skills.

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

Not completely: the support of an a computer expert, specialised in digital databases, is required, not only to start with DiSSCo but even to ensure that forthcoming updates or new requirements (from DiSSCo itself, but also from the Institutional side) are fluently acquired, without either slowdowns or redundancies.

**Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?**

We list here the main competencies we think that should be considered, for both the improvement of the permanent staff skills and the training of new members (either permanent or for a fixed time). This is why we also think it is important to include also the skills that are expected to be already acquired by the museums staff.

For the curators:

- 1) Museology: which is the role and the way a museological collection is set and organised, which kind of information the specimens can provide, etc.
- 2) Taxonomy and nomenclatural rules: principle for the formalisation of systematics results, principle of priority, status of a name, typification etc. (everything which is needed for either the interpretation of a label and its translation in its digital twin).
- 3) Imaging and databasing: general structure of a database, ontology, nomenclatural standards and MIDS, resolution etc.
- 4) Regulations and legal constraints: how to ensure that each procedure and each practice complies at the same time with institutional/local/national/international rules and commitments.
- 5) Digitisation planning: which are the different "values" of a specimen or a collection, which are the criteria to prioritise in a digitisation plan, defining the policies for the different kinds of digitisation (massive, on demand etc.).

For others (dedicated staff - different from the curators):

- 6) Financial planning and administrative management.
- 7) (advanced) Regulations and legal constraints (personnel in the legal office).
- 8) Computer science.
- 9) Communication and outreach.

### 3. Training design

Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:

#### Profile of the staff

As a rough design, we think it should be provided a two-level training for each of the above-mentioned (question 2.3) competencies, i.e.: 1) the first one as mean to refresh the already existing skills of the specialized staff, to align with updates and new requirements and to provide the trainers for the local iteration of this activity (following the train-the-trainers principle); 2) the second one, starting from the more basic principles, specifically dedicated to the newly hired staff and/or to fixed-term personnel engaged for special activities. [As for the users or other "external" stakeholders - i.e., not the staff - maybe, a third training channel could be useful, or even as many different training "pathways" as the number of different identified stakeholders...]

*Tasks and possible challenges related to the use of DiSSCo*

#### Priorities of the Organisation

- 1) Ensuring that each institution is well aware of DiSSCo' purposes and principle and is able to drive the management, the digitisation of its own collection, the research activity and the communication approach with DiSSCO and the international community as a background.
- 2) Ensuring the alignment of each department within each institution with the same CMSs and the same practices, as defined with compliance to the international standards (we're still far from this especially in the most of medium- to small-sized institutions).
- 3) Making the DiSSCo services and facilities the easiest way to approach the daily issues and commitments, thus driving a natural shift from the old systems to the new ones, even before that a structured training offer is available.

*Related to the Digital Strategy*

#### Delivery channel and time to be allocated to such a task

Most of the training courses should be delivered through face to face activities (including the practical ones) to be effective. Nevertheless, tutorials and other "on demand" material can (must) be provided in order to both strengthen or recap the acquired skills and to warrant a quick and smart training of fixed term personnel (as well as of other stakeholders).

#### Needs of the staff

Same as those listed under 2.3 as main competencies, through two separate channels:

- 1) Training in basic skills.
- 2) Periodic updates.

#### Contents of the Course

Again, same as outlined in the section 2.3 of the present questionnaire. Among the main contents, some are commonly provided by either institutional courses dedicated to the staff or by the standard educational (academic) offer, which are open to the staff too. For others - especially those with interdisciplinary fallout, e.g. the collections curation - most of the skills are developed through the direct practice, since the current landscape does not offer any special training activity. Here, there is a need that additional efforts are done, within the DiSSCo context.

*If necessary, make references to existing courses offered in-house or through external training providers*

#### Optimization and localization of the Training Strategy for my Organisation

Nothing special to suggest here, except the need that the during the DiSSCo Construction or early Implementation phase a strong effort is provided in order to create the needed link between the "core teams" (including, at least, the current NNs plus the technical and scientific community involved in the DiSSCo related projects) and the local trainer that will be in charge to transfer the information. Afterward, we think that in the "DiSSCo era" an almost "physiological" transfer will be ensured, as it has been until now for many of the (traditional) need skills within ur communities.

## Untitled

### Name

Lorenzo

First

Cecchi

Last

### Institution

IT-UNIFI-MSN [Natural History Museum of the  
Firenze (Florence) University; current Italian NNs]



# 15 ANNEX 7: MNHN CONTRIBUTION

## 1. Expectations

*Please provide a short paragraph per topic/question.*

### How will the implementation of DiSSCo RI affect your organization?

The implementation of DiSSCo is in line with the trajectory of the French National Museum of Natural history (MNHN), which has been involved in European collaboration for many years. In more detail, the DiSSCo infrastructure will strengthen the links with the other institutions involved, and increase the valorisation, access, and research output on naturalist collections. On a strategic level, the implementation of the infrastructure will enhance the MNHN's position in regard to the Ministry in terms of leadership related to access to naturalist collections and their data for research purposes. Already strong and structured with the management of the national infrastructure Récolnat (French national network of Naturalist collections), participation in DiSSCo will allow new collaborations and associated movements of specimens, data, and skills transfer through training.

From the point of view of services, MNHN envisages positioning itself to develop, support, and maintain ELViS, in direct alignment with a modernised version of its institutional tool called Colhelper, thus allowing a better workflow in requests for visits, and loans, but also associated Access activities (digitisation, analysis, etc.).

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

### Which are the key expectations from your organization in relation to the DiSSCo RI?

The key expectations can be resumed as follows:

- Mass digitisation and data production of a corpus of 2D and 3D digital twins. These data will be mainly associated with the digitisation of collections of vertebrates, arthropods, and terrestrial and marine invertebrates over several years;
- Creation of interfaces and online services associated with the data produced. This involves the specification based on the use cases identified with the users and partners of the project, of the functionalities and services of provision and data enhancement from a web interface;
- Supporting change and new shared best practices within staff involved in naturalist collections (curators, researchers, technicians...), policymakers, and open data practices.

Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.

MNHN's digital strategy is in the process of being redesigned and modernised. The alignment of its institutional trajectory with that of DiSSCo is part of this. The key axes are the following:

- Changing the information system for collections and research (CMS, links with research general directorate, use-cases, open data, loans and visits, data hub...);
- Standardisation and articulation with intra-national and international levels (DwC data standards, policies...)
- Improve digital and physical access to the collections;
- New collective projects and new transversal structures among the area of expertise (conservation, regulation, digital innovation...);
- Offer staff opportunities for training and mobilities;
- Align institutional, national, and international strategies.

*Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.*

## 2. Possible Risks and Obstacles

Please provide a short paragraph per topic/question.

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

MNHN is currently in the process of transforming and modernizing both its IT and digital systems. In this context, the institution - associated with a consortium of partners - is engaged in a new project called e-Col+, with the purpose of promoting naturalist collections data in France through digitization and enhancement of a large corpus of data from part of its collections of specimens (vertebrates, terrestrial arthropods, marine invertebrates). In addition to mobilizing a project team capable of achieving the objectives set, it requires the contribution of new IT methods and tools, particularly in 3D digitization and artificial intelligence.

At the institutional level, specific support for change is planned to ensure that staff are involved in and drive the changes planned as part of the information system modernization. This support will be transferred and shared with other institutions within the French national network of naturalist collections to provide general alignment.

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

The staff has most of the necessary skills, but they do not have enough dedicated time to make these changes smoothly. Several processes of consultation, participation and a training and support plan are planned. New professionals will have to join our teams (data managers, and data quality officers...).

In addition, following MNHN's participation in the TETTRiS program, a link with the MOSaic research unit will enable a pool of skills to be mobilised between research in biology and systematics and bioinformatics tools.

**Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?**

MNHN wishes to engage in the adaptation of its internal loan and visit management tool (Colhelper), in order to modernise and develop it into a multi-institutional e-service and deploy it at the European level. These developments would make it possible to make the most of MNHN's experience and to propose an ergonomic ELViS based on user stories within the DiSSCo RI. The skill requirements for this development are the following:

- Project management, coordination, and organising user stories;
- Web developer;
- Coder and digital architecture;
- Organising the long-term archiving of data;
- Responding to the challenges of the GDPR, while enhancing access to collection data.

[https://docs.google.com/document/d/1RsjJbXKKQ\\_0R3-ZBvDQjmsJ8YBi9fIGB/edit#heading=h.1pxezwc](https://docs.google.com/document/d/1RsjJbXKKQ_0R3-ZBvDQjmsJ8YBi9fIGB/edit#heading=h.1pxezwc)

## 3. Training design

Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:

**Profile of the staff**

**Needs of the staff**

Please see the "Profile of the staff" section.

a/- Collection-oriented training activities Staff is composed of: (i) Collection curators and Researchers, Collection managers, Collection technicians  
 Tasks: teaching the curating process and workflows: from the entrance of samples to the collection (after sampling), preparation for long-term preservation, recording in the public databases, and digitisation (by imaging or other sources of specimen-related data). Challenges: The staff has the necessary skills, but they do not have enough dedicated time to make all of the curation processes. Training courses should allow data production while there is already a lack of staff to do this work. New programs – such as Synthesys+ - are of great help to increase the production of new data and data mobilization.

b/- Digital-oriented training activities Staff: Some researchers and technicians are already involved in digitisation and its technicalities. Tasks: There is a need for training to address both the scientific concepts and the technologies that allow them to be exploited in order to facilitate all collection-based research. Technology is evolving very rapidly and updated knowledge is also essential. For example, new generation images and annotations could be addressed.

c/- Policy-oriented activities

Staff: Policy Department and museum registrars.  
 Task: A training plan for regulations related to the management and circulation of collections in order to democratise them would be useful. Continuous training of users is a key point for good practices and their harmonisation at the European level.  
 Challenge: Lack of skilled or available staff.

*Tasks and possible challenges related to the use of DiSSCo*

**Priorities of the Organisation**

**Contents of the Course**

The priority for MNHN is to redesign its Collection/Research information system in order to align its digital transformation in relation to collection data at the European level, and in accordance with open science and FAIR data. A quality officer in charge of the quality and homogeneity of data entry practices will be at the heart of the success to maintain a high level of data quality.

*Related to the Digital Strategy*

In 2023 MNHN's training program for its staff will concern :

- Regulations related to the status of objects and their impact on studies and movements;
- Training in the use of the new tool for managing loans and visits to collections (Colhelper -> Muse);
- Identification of needs for a new CMS allowing ergonomic input of specimen description fields with several points of attention: links with standards, reference systems, data quality improvement, etc.
- Support for a change in new digital practices.

*If necessary, make references to existing courses offered in-house or through external training providers*

**Delivery channel and time to be allocated to such a task**

The necessary training plan for the training of staff must be in place by 2026 in order to be operational when the DiSSCo ERIC is launched. These few years are necessary because the dedicated staff to the collections is more than 200. A special training plan could be thought for volunteers who can be of great value to computerize specimens.

**Optimization and localization of the Training Strategy for my Organisation**

The new training program linked to the overhaul of the information system will enable skills to be updated and, above all, an attempt to harmonize practices in alignment with the new DiSSCo RI. On the other hand, a "Taxonomy plan" will be developed by MNHN, particularly on digital aspects and within the TETTRiS project.

## Untitled

**Name**

MAGALIE

First

CASTELIN

Last

**Institution**

MNHN

# 16 ANNEX 8: ULISBOA CONTRIBUTION

Εργαλείο αποκομμάτων

## 1. Expectations

Please provide a short paragraph per topic/question.

**How will the implementation of DiSSCo RI affect your organization?**

The implementation of DiSSCo will increase the Institution's readiness for digitization.

You may need to further elaborate based on different levels, such as: overall (entire institution), departmental (specific departments, e.g. collections, etc.) and individual (the staff involved).

**Which are the key expectations from your organization in relation to the DiSSCo RI?**

We hope that making part of an pan-European RI will call attention, at national level but also at the University level (we are an university museum), to the importance of natural history collections. At the institution level, we expect that DiSSCo RI will help place digitization as a priority for the institution. That will impact staff hiring, allocation of funds, and fundraising.

**Please highlight the key axes of your organization's Digital Strategy and then try to position DiSSCo within this Strategy.**

We are still preparing the Digitization strategy, involving the different scientific areas of the Museum. DiSSCo plays a central role within this strategy since we expect to use RI to get training and use e-services.

*Should it not be in place yet, please indicate if there is a plan towards a digital transformation in your institution and how this may articulate around DiSSCo RI.*

## 2. Possible Risks and Obstacles

Please provide a short paragraph per topic/question.

**Are the members of the staff ready for the (digital) change that DiSSCo may imply?**

The staff members are at different levels of readiness but we would say that they all need further training to be ready for the envisaged digital change.

**Do they possess the necessary skills? If not, are missing skills to be introduced via new staff?**

The existing staff needs to be trained to improve their skills and competencies. It is unclear whether the Institution will be able to hire new staff to fill the missing skills.

**Chapter 4 of the Strategy presents a detailed list of necessary competencies. Could you highlight the ones that are related to the case of your organization?**

This has already been answered in the first questionnaire. Please check our answers then.

## 3. Training design

*Based on the above, let's design a scenario (using DiSSCo) that could be the reference point for the design of a training programme for your organization:*

Profile of the staff

Needs of the staff

Curators with great taxonomic expertise but with low skills concerning digitization processes and data curation.

Collection manager that still needs training concerning management skills

Technicians with different levels of digitization readiness.

No staff for digital data management and curation.

*Tasks and possible challenges related to the use of DiSSCo*

Increase skills and knowledge of the existing staff concerning:

training concerning:

- best practices and workflows for digitization of different collection types (data capture and 2D imaging)
- Data quality
- collection management -- digital workflows to support key collections management processes such as accessions and loans
- management of digitisation projects

New staff for:

- Digital data management and curation
- advanced digitization (e.g. 3D imaging and image analyses)

**Priorities of the Organisation**

- increase digitization skills of the existing staff
- hire new staff for digital data management and curation
- hire temporary staff to do digitization work

*Related to the Digital Strategy*

**Contents of the Course**

- Training concerning:
- best practices and workflows for digitization of different collection types (data capture and 2D imaging)
  - Data quality
  - Digital data management and curation
  - advanced digitization (e.g. 3D imaging and image analyses)
  - collection management -- digital workflows to support key collections management processes such as accessions and loans
  - management of digitisation projects

*If necessary, make references to existing courses offered in-house or through external training providers*

**Delivery channel and time to be allocated to such a task**

online courses will make training more accessible

**Optimization and localization of the Training Strategy for my Organisation**

do not understand this question

**Untitled**

**Name**

Maria Judite

First

Alves

Last

**Institution**

ULisboa - Museu nacional de História Natural e da Ciência