Adapting the information professionals to the digital collections universe

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Abstract

Libraries, Archives and Museums (LAMs) should respond as one articulated entity to the user informational needs and to the demands of the scholarly electronic communication. LAMs are stepping forward into the arena of digital stewardship and this move requires new skills and abilities. The specialists are adapting practices and instruments to the pressing needs for digital curation and preservation. The necessity for an active and continuous partnership between the information-intensive organisations, the scholarly community and general public, must be ensured while incorporating the paradigm of guiding the user and empowering the researcher. There are important questions that future digital stewardship raises related to how the professional profile will look like for those powering the specialised structures put in place to safeguard cultural and scientific heritage. What will be the core competences based on what set of skills and abilities? How will the facilities look like? What will be the general environment, and most importantly, will there be a space for common knowledge exchange for those entrusted with maintaining vast bodies of information. The article searches for answers related to the shifting core competencies, future set of skills and abilities and how future facilities will be shaped by these evolutions. The first step is the establishment of spaces especially destined for knowledge exchange to help converge disciplines within LAM framework. Different structural and cultural chances are revealed, starting from job adverts up to the policies addressing the needs of information and knowledge management.

Keywords: library evolution, archive evolution, museum evolution, LAM, digital stewardship, convergence, collaboration, information specialist

Contents

1. Introduction

The historic phase we are crossing belongs to the information society. Political structures are designating branches inside their administrative circle using buzzwords like Information Society, Knowledge Society or Innovation Society. Many Governments dedicate resources to fulfil the vision carried by these concepts and the entire underlying structure is based on electronic services.

There is a continuous trend to put an "e" to as many traditional domains from business to culture. One might think the times we are living are destined only to fulfil this purpose. Let alone the shift in the administrative services, a shift is produced on every level of the society. This upheaval is based on the underlying fabric of mashed electronic services.

The question is to what particular use this transformation leads to? Arguably, adaptation and internal conduct of "e" profiled businesses is following a very slow process and memory institutions are no exceptions. This progressive evolution drives a need for changing the way we interact completely. Many specialists are embracing a more open communicational behaviour leaving behind unproductive competitive behaviour mostly where public institutions dedicate their resources to aid the user. However, slowness of this process comes to reveal constant collisions with arbitrary individual, political or economic interests.

In spite of economical hardships, we can still see human and financial resources being allocated in order to build and sustain dedicated electronic infrastructures. This happens because they are believed to ensure a pervasive potential for change in the informational climate and by doing so, adding continuous value to a common body of knowledge.

One of the most important aspects is man powering the infrastructures accordingly, through the evolution of the skills and their continuous professional development (CPD). The global implications of this aspect have not undergone a thorough scrutiny reflected accordingly into policies. In fact, this aspect is built in the core of the development of the future's electronic environment.

Libraries, Archives and Museums, on short LAMs should be further developed and evolved for they are vital components of every nation's cultural fabric. These institutions – memory institutions – are marching towards meeting their foreseen reunion in the common effort to satisfy user's informational needs. If they are to be successful in their bondage, they have a real chance to become gates of knowledge. Evolving to such high status requires a change in every LAM professional field. This process takes time and most of all voluntary action to step forward on cross-domain collaboration. For the key-term of this study, the "information specialist" was chosen as a common denomination for the various profiles of the professionals evolving in the framework of the management of electronic collection. Interchangeably, information specialists appear as LAM specialists. Some variations in terminology are to be observed, and that is due to the fact that they reflect different roles.

2. A lively job market

In order to establish a research base, it is necessary to have a look upon some real cases and see what are the real needs expressed by the stakeholders who develop complex informational services. What qualifications do fit a particular institutional profile and most of all who are those from whose competencies the electronic scientific and cultural heritage awaits for long term solutions. A suitable point to start is the vacancy positions advertised on the channels for specialists. Some of the highly relevant adverts were selected based on their relevance for a possible future profile of the specialist, whose evolution depends on a specialised set of skills and abilities, for they are called to regulate the information flow.

For this purpose, we consulted with the main profiled mailing lists with the intent of sampling the job vacancies being circulated among the specialists who are active on the following: BOAI Forum, dcc-associates mailing list, DIGITAL-PRESERVATION – JISC mailing list and American Scientist Forum. After consulting with these sources (meaning the message archives), 9 different job openings were chosen: 3 of them involving management responsibility (2 managers[1], 1 director[2]), 2 officers[3], 1 specialist[4], 1 research assistant[5], 1 senior developer[6] and 1 analyst[7]. These were chosen for the multiple similarities in the skill sets and abilities requested. After a filtering, the following similarities emerged.

All of the vacancies entail in description that the perfect candidate will have to:
- Manage day-to-day operation of the research repository service,
- Be involved in public relations specific activities in promoting the repository internally, locally and internationally,
- Provide assistance to different stakeholders,
- Provide training and information for others in the organisation (knowledge exchange facilitator),
- Be involved in overseeing different internal strategies and implement policies and procedures,
- Have to be well fit to understand data modelling in general,
- Ensure the effective and robust transfer of information.

A profile of the requirements has been refined and it has the following points:
- Recognised professional qualification (at degree or postgraduate level) in librarianship or information science,
- Familiarity with repository software and metadata standards,
- Understanding of open access,
- Understand of what curation of data (including electronic preservation and associated technologies) is and what management of research data is,
- Good understanding of digitisation processes,
- Good knowledge of Cultural and Heritage Informatics and Digital Humanities,
- Tertiary qualification in information technology/computer science qualification (database technologies).

The question is not if this general profile as it is presented above fits all future requirements for the new bread of information specialists, but by what time will all job vacancies postings look like this and is there a coherent response from the community of practitioners? At this moment those who are chosen to fill in the positions are not the beneficiaries of some structured educational curricula

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1   Repository Services Development Manager and Digital Preservation Project Manager

2   Director of Digital Curation Centre

3   Research and Enterprise Officer and Research Institutional Repository Officer

4   Digitisation and Digital Preservation Specialist

5   Research Assistant in Metadata Standards

6   Senior Developer for Digital Archive

7   Digital Archives Analyst

nor a career path easy to distinguish. Exceptions may exist but in most cases they are self-taught persons benefiting from the experience of daily work, sometimes following specialised curricula in postgraduate programmes, and at best following short training courses or attending relevant events.

2.1 Why should we address such a concern?

A) Because in the digital environment the differences between different memory institutions are fading. The future belongs to a body of specialists who are coherent and smoothly articulated in practices:

> "Therefore, on practical level memory institutions explore possible ways of collaboration and on the theoretical level convergence or, at least, closer interaction and interchange of knowledge between museology, library and information science and archival science is considered as a future of the disciplines. In higher education these trends result in experimental curricula, which integrate studies in LIS, museology, and archival science."[8]

B) Because the pressure is increasing on the shoulders of different field practitioners (LAMs) to come to a common ground with regard to practices, standards, tools and means to achieve efficiency. Putting user needs in the centre will eventually lead to build faster common frameworks for cooperation. This is expected to happen as LAMs are bound to become knowledge management units based on electronically articulated frameworks for information and data management.

In the end it comes to a visible shift from collection stewardship to knowledge aggregation and dissemination.

C) Within the *Conceptual framework[9]* it is stressed that *early experiments with teaching "digital" disciplines reveal the need for integration of them into the general body of knowledge of LIS*. Argumentation for the conceptual framework of Digitisation of Cultural Heritage reveals another valuable aspect that should be taken into consideration carefully for the purpose of future avoidance:

> *Isolation of ICT-related disciplines from such themes as the main library functions and roles in society, library services and operational processes etc. has resulted in internal fragmentation within LIS domain. Both on the research and practical levels the consequences are concentration on narrow purely technological issues and producing applications or services that doesn't match the actual needs of the society (e.g. digitized collections on the web, accessible for all but at the same time not usable because of inconsistency with the needs or the level of skills of users; sophisticated cultural heritage applications that don't consider social, economic, cultural factors of real-life situation etc.).*

D) Because right now, the awareness of digital curation/preservation is low. The actions are led by the research community followed at distance by social sciences and humanities (*planning beyond the phase of digitisation is, for the moment a bridge too far*)[10]. However, a time will come when the amassed body of digital collections will enforce one course of action. That will be the key-moment when LAM specialists should be dully prepared to give answers and come with solutions.

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8   Leif Kajberg, Leif Lørring (Eds.) (2005). *European curriculum reflections on library and information science education.* Copenhagen: Royal School of Librarianship and Information Science. Available at http://www.library.utt.ro/LIS_Bologna.pdf

9   Zinaida Manžuch, Isto Huvila and Tatjana Aparac-Jelusic. (2005). Digitisation of cultural heritage. In Leif Kajberg, Leif Lørring (2005). *European curriculum reflections on library and information science education.* Copenhagen: Royal School of Librarianship and Information Science, 37-60

10 Inge Angevaare (Ed.). (2009). *A future for our digital memory: Permanent access toinformation in the Netherlands.* (interim report). The Hague: Netherlands Coalition for Digital Preservation. Available at http://www.ncdd.nl/en/activiteiten-natverkenning.php

2.2 A starting point

To explore possible future outcomes in a dynamic job market, one should take a look at the direction in which skills and abilities are headed. Many of the requirements involve today a good knowledge of the electronic environment but also notions concerning knowledge management and knowledge organisation systems. All the efforts should be pointed towards meeting the informational needs of the digital literate citizen[11] and of those (scientists and specialised communities) who seek specific guidance in using the informational services efficiently.

Information Seeking and Information Retrieval stands as basis for LIS education. The *European Curriculum Reflections on Library and Information Science Education* has a chapter dedicated to this fundamental topic. IS&R should be regarded as basis for all LAM disciplines and together with knowledge organisation it should help in finding a clear path in every curricula and training syllabus. A relevant aspect in aid of the trainer is that IS&R establishes tight relations with Information Literacy leading to a very strong convergence within the formal and informal educational sphere. The result is generation of solid core competencies for the information specialist. As a conclusion, Cultural Heritage and Digitisation of the Cultural Heritage, Knowledge Management, Library Management and Information Society themes build on Human Information Behaviour, Information Seeking and Information Retrieval. Some core concepts are relevant in this context:

- *Human information behaviour; information seeking; information retrieval*
- *Knowledge; information; document; resource; retrieval system*
- *Information need; information access; information use; becoming informed; information literacy*
- *Relevance; utility; satisfaction; evaluation of information*
- *Content; context*
- *Knowledge organisation; indexing; vocabulary; information representation*

But, the very basics for specialist development lay in the very foundation of information abilities[12]**:**

1. *The ability to recognise a need for information,*
2. *The ability to distinguish ways in which the information 'gap' may be addressed,*
3. *The ability to construct strategies for locating information,*
4. *The ability to locate and access information,*
5. *The ability to compare and evaluate information obtained from different sources,*
6. *The ability to organise, apply and communicate information to others in ways appropriate to this situation,*
7. *The ability to synthesise and build upon existing information, contributing to the creation of new knowledge.*

Sometimes these abilities are treated lightly and are considered to address general public and not the specialists. Nonetheless, together with technical abilities they form the ground bases for training and CPD. Professionals should be able to cross the boundaries of their initial qualifications in terms

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11 Digital Literacy: Skills for the Information Society (2007, March). Available at
http://ec.europa.eu/information_society/tl/edutra/skills/index_en.htm / *digital competence involves the confident and critical use of information society technology (IST) and thus basic skills in information and communication technology (ICT)* -
http://europa.eu/legislation_summaries/education_training_youth/lifelong_learning/c11090_en.htm

12 SCONUL Task Force on Information Skills (1999). *Information Skills in Higher Education*. London: Society of College, National and University Libraries. Available at
http://www.sconul.ac.uk/groups/information_literacy/papers/Seven_pillars.html

of appropriation of new skills and abilities beyond the basic domain. Convergent to information literacy, the specialists must be digital and media literate[13]. This process of adding up should be stimulated in the institutional environment and not appear as the result for searching a particular solution.

European policy level expressed an interest related to digital content preservation as a need for "***improvement of the skill base*** *by creating mechanisms for the* ***exchange of knowledge and skills,*** *and for the ongoing* ***identification of emerging skills requirements and training needs.***"[14]

Although the foundation should be solidly described by the converged points above, there is general acceptance that the right description of the position within the institution as a response to real needs is not presenting itself as a clear landscape. A profile of the job requirements reflects only a momentary and incomplete facet of the multiple challenges he/she will be confronted with. There is also another aspect to be seen happening. Although people with new skills are attracted to a working environment, in turn they receive a very slow response from the institutional background, which leads to a waste of potential and morale loss.

There is a need for more analysis of the core and general competencies as well as a detailing of the training opportunities needed to ensure a framework for continuous professional development.

2.3 Some scenarios in which information specialists will be evolving

In-house

When it comes to managing data or several electronic collections of digital assets, the most visible reaction out there is to call on the internal computer department and request help. The computer scientists are expected to be knowledgeable with regard to all the complexity that running such a specialised service might require. Usually the response is mixed and is based on experience as well as the alternative information channels that form the inside knowledge of such a department. The problems start when the department does not offer strict calibrated responses to those who are producing the digital assets as the latter would've expected to. Here appear issues with regards to structured document management, archival principles that have to be followed and most of all following procedures related to long-term preservation. Computer scientists may offer technical solutions provided they have the expertise in choosing proven technologies but in any case he/she is not to be expected to offer also a view on the whole process. The risks the collections are presented with are more easy to be assessed and also a tight control on technical evolution is possible as well.

Externalisation

The second reaction is a move towards externalisation of the needed services with the cost of running a fragmented environment (in the sense that there is not really a full control of the electronic resources) which in turn induces some certain negative aspects when it comes to the project's whole life cycle of the collections. But reality confirms these tendencies as a natural response to align a particular outcome with efficient costs running. The immediate effect is often seen in how the staff perceives such a decision and there are indications that they usually sense the

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13 *Media literacy relates to the ability to access the media, to understand and critically evaluate different aspects of the media and media content and to create communications in a variety of contexts.[...] It is a fundamental skill not only for young people but also for adults and elderly people, parents, teachers and media professionals.* http://ec.europa.eu/avpolicy/media_literacy/index_en.htm

14 COUNCIL RESOLUTION No 162/2002 of 25 June 2002 on preserving tomorrow's memory — preserving digital content for future generations. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002G0706%2802%29:EN:NOT

assets do not belong to them any more. They are becoming a mere portfolio separated from the core business output – an added value product, but a remote one.

Of course this is available in the case of the electronic environment with a strong accent on digital assets produced and with the "digital born" resources. Once again the issue of technology and a policy with regards to long-term preservation comes to focus. To all this some side effects are to be seen at times sluggish communication with the external partner, technical difficulties or even unexpected risks like bankruptcy for instance which create disruption of services. Usually the most endowed institutions answer possible service disruptions through fail safe cascading like mirroring. But these measures raise the total cost. Some of the risks are also emphasised in DRAMBORA[15]. The Digital Repository Audit Method Based on Risk Assessment (DRAMBORA) is a methodology for undertaking repository self- assessment, developed jointly by the Digital Curation Centre (DCC) and DigitalPreservationEurope DPE).

Consortia establishment

Another type of reaction is moving towards establishing consortia for managing the electronic resources collectively, according to the specialisations of the partners – a context for symbiotic responses and harmonised articulation of services and contributions. This type of response is based on cooperation and usually such environments are not run without problems. The communication channels clog in administrative and coordination issues. Most of the problems arrive when one of the partners runs aground with the funding or simply stop its existence. Here, there is a clear need of specialists capable of giving advice and also of being strictly focused on the risk issues of whatever nature may arise in such a complex layout.

Project driven consortia

Another picture similar to the consortia is the project-driven coalitions which are the most visible ones in terms of activity and outputs and also the most volatile with regard to preservation and long-term access to products and services as generated resources. The most successful cases are those in which consortia find the resources to continue work in the form of spin-off-like associations, foundations, etc. - generally non-profit organisations. But such success is not to be widely seen.

2.4 The information specialists as digital stewards

The information specialists find themselves in key-positions being able to turn a change in their own institutional environment. The managerial level should prove catalyst qualities for this process of evolving the entire environment.

Some practitioners distinguish themselves as scientists being also computer literates, librarians with digital managerial skills, consultants with various expertise, and in some fortunate cases even programmers converted to digital assets stewardship. A clear differentiation of the various roles is hard to make.

There are cases where the institutional structure reflects a conservative view with regards to their existing human resource. Sometimes managers fall into a subtle gap thinking that as long as funding is provided all matters with regards to proper specialisation response to a certain matter might be easily managed. This is to be regarded as a gap because it indicates a dependency of a model that in times of crisis proves to be the least effective.

This is also the signal pointing to an opportunity for a change of the institutional environment all together. Following this trail the way that existing personnel is looked upon should suffer a deep change. The personnel proves times and again to be the most valuable knowledge base, when given a stimulative environment. In turn, solutions spurred inside a stimulative and collaborative environment lead to economical advantages as well. Large funding dependency may be tackled if

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15 Digital Repository Audit Method Based on Risk Assessment

investments are made to boost existing personnel training and cross-domain specialisation. But, without creating a stimulative environment, all other efforts lead to an inefficient approach.

The digital steward – specialist(s) capable to devise a strategy and to offer applicable responses to specific needs in curation and preservation of digital assets – are at this point at a crossroad where the solid core is the base specialisation but their daily jobs push them into a continuous cross-domain swirl. In time they accumulate a different type of knowledge body that has to find a proper response in the institutional environment in order for it to be harnessed. She/he may be regarded as pioneers and also agents of change in the institutional framework where they evolve. Usually they succeed in stimulating a new type of approach to information management and doing so by adding new skills and practices. Once again the management level has to stimulate this change and not act with indifference or worse. Changes induced by the new way of doing things should be slipstreamed into the decisional process.

The real power of every institutional environment are people and together in a connected expertise-sharing setting, they are forming a strong body of knowledge. They are capable to change the entire institutional environment towards boosting the internal benefits in terms of added-value products and services, with cost efficiency as well.

In the recent Report to the JISC[16] made by Key Perspectives it had also been acknowledged that there is no clear understanding of the various roles reflected by the practical experience of those who are in charge with organising the information environment, but as the starting point stated, it is the term "data scientist". This report distinguishes roles attributed to data field: data creator, data scientist, data manager, data librarian.
Of a particular interest is that the data librarians are distinguished as "people originating from library community, trained and specialising in the curation, preservation and archiving of data".

Summary:

In most of the cases information specialists are not the beneficiaries of previous structured educational curricula, nor a career path easy to distinguish.
The differences between different memory institutions are fading seen from the beneficiary's end.
Putting the user needs in the centre push LAMs to establish common frameworks for cooperation.
Pillars for core competencies:
- information literacy,
- media literacy,
- digital literacy.
Digital stewards are pioneers and also agents of change in the institutional framework they evolve.
Personnel proves to be the most valuable knowledge base who needs a stimulative environment.

3. A larger arena for librarians, archivists and curators

All the main actors, let those be LAMs (Libraries, Archives, Museums), public administration bodies, research funding agencies and even private institutions, all share an increasingly common need for expertise related to managing bigger and bigger volumes of information and data. Beside this there is a need for better contextualisation and visualisation tools and expertise to be applied on this massive body of information. Extracting meaning is the ultimate goal and this is a human resource intensive task. Intelligent agents may be capable of setting relevance criteria, but the

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16 Alma Swan and Sheridan Brown (2008). *The skills, role and career structure of data scientists and curators: an assessment of current practice and future needs.* Truro: Key Perspectives. Available at
http://eprints.ecs.soton.ac.uk/16675/

context setting progress is based on human contribution only. There is also another aspect related to the amount of digital born objects build-up which is putting a constant pressure on managerial decision process and also on those who contribute to it as well (discovery, reuse and re-purposing).

These digital objects may reflect a wide range of activities which add up to a growing body of knowledge. In the process proper mechanisms have to be devised to ensure and to protect the contributor's recognition and entitlement to benefits.
There are to be seen increased efforts to bringing massive bodies of literature into electronic form through large digitisation programmes which adds up to the difficult task of long-time preservation as well. All digital artifacs are presenting themselves as continuous flows of information often accompanied by streams of data.
In order to understand the position of the specialists better and most of all what their role would be in the future, two illustrations were devised to understand better the context of the future changes. The first one represents the environment in which the requirements for the future information specialist are continuously shaped (Illustration 1) and the second highlights the areas of responses to which his competences will be applied (Illustration 2).

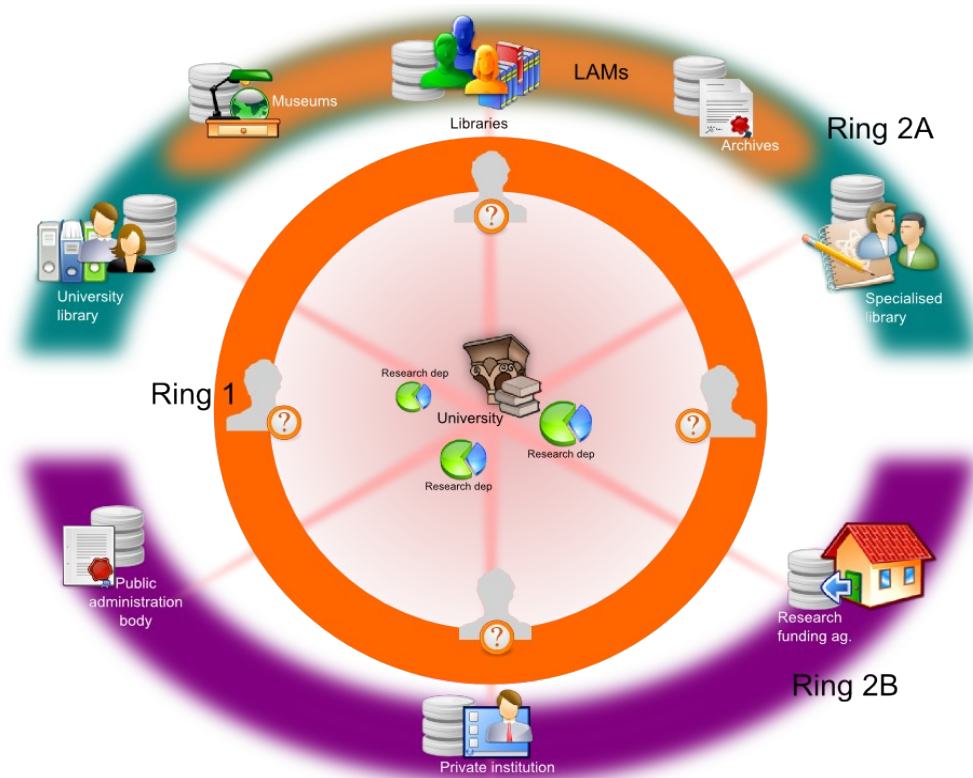**The First circuit – Ring 1/Ring 2A**

Illustration 1: Two rings approach – data collections universe

For reference we will use herein the concept of *data collections universe* with the same meaning given in the National Science Foundation report[17].

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17 National Science Board (2005). L*ong-Lived Digital Data Collections Enabling Research and Education in the 21st Century.* National Science Foundation. Available at http://www.nsf.gov/pubs/2005/nsb0540/

This first circuit is one of the most productive with regards to cultural heritage, scientific and educational literature resources. It proves to be a veritable mesh-up of different services and sources having the knowledgeable user at its centre.

All of the actors involved are already developing services that stride to offer the best infrastructures to their users and contributors. This involves electronic publication services for the different kind of contributions covering research articles and open monographs, OERs (Open Educational Resources), and also well-articulated institutional repositories dedicated to wide dissemination of research plus their associated data sets. There is a growing body of cultural heritage reflected in electronic representations issued as the results of digitisation efforts. These resources have special needs as they have to be insured to the beneficiaries with an authenticity weight that cannot be achieved unless they stay "in touch" with the original. This special body of knowledge translates in the end into massive electronic collections (digital libraries) that are to be submitted also to curation and digital preservation.

The resources exchanged in this scenario need to be curated and preserved in a flexible manner adapted for internal use and also for external exchange with third parties.

As it is seen, the university is put in the middle of the information brokerage market. It is an important player that currently has the capacity, via its research departments, to be the major scientific content contributor as well as a solution provider for the specific needs. Universities communicate through open channels with the memory institutions around them in a continuous partnership in order to evolve further the theoretical and applicative research, and also to complement and sustain teaching and training processes. Universities are also those who have the utmost responsibility when it comes to training of those who will serve the future institutional partners in the Ring 2A.

Universities take part in many project partnerships related to cultural heritage dissemination as facilitators to research and providers for technical solutions. Many times universities are to be seen as partners in different consortia established to aggregate and disseminate cultural and scientific heritage, many times in collaboration with their libraries.

There is another view that I would like to bring about to this perspective and it is described by Anna Gold[18] in three distinct tiers:

National infrastructures: *a small number of research libraries, working with government bodies, professional organisations, and industry, will have a large role in helping to formulate national digital data curation strategies, including economic models to support curation over long term.*

Campus infrastructures: *a large number of libraries and librarians will actively support the development of campus-based data curation services.*

Professional development and education: *Graduate programs in library and information science are developing to support professional roles in data curation.*

Another important aspect is that the universities take on the role of becoming the cradle of future commercial or network driven collaboration spin-offs as well. In fact, as it is seen reflected through EU policies and programmes[19], universities are stimulated to also develop relations with the private initiatives, as they are expected to become centres of technological transfer. This type of

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18 Anna Gold (2010). *Data Curation and Libraries: Short-Term Developments, Long-Term Prospects*. Office of the Dean (Library). San Luis Obispo: California Polytechnic State University. Available at: http://works.bepress.com/agold01/9

19 COMMISSION RECOMMENDATION on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations (Text with EEA relevance). http://ec.europa.eu/invest-in-research/pdf/ip_recommendation_en.pdf

stakeholder is also linking with the others from Ring 2B. They are beneficiaries and act as a bridge between the institutions in the Ring 2A.

All these aspects are revolving around a circuit (Ring 1) that powers their evolution: highly trained professionals. And by that meaning people that are able to find, collect, organise, store, curate, retrieve, interpret, transmit, transform, and use the information[20].

The second circuit: Ring 1/Ring 2B is one of a particular aspect because it stores different targeted types of data and information.

These stakeholders show particular interest in long-time preservation, authenticity, re-use and continuous access as they create and maintain large collections (*public sector information* – PSI[21] and *public content*) out of which some with high societal and administrative value. At one point there are clear separations with regard to needs and it is quite clear that Ring 2A and this one are closely related and in a relation of dependency. Of course, there are some particularities to be observed, like the private bodies where the preservation needs are in close entanglement with the strict requirements of business, but even here, when, let's say, cultural content is the business directly or via public private partnership, the same rules apply.

There is another aspect here that has to be taken into careful consideration. Many of the stakeholders in this ring produce content (PSI mostly) that is disseminated through portals for the benefit of the general public. This content is dynamically created and it is in a continuous change, as different administrative and political contexts develop. There is also a need to preserve this content for future reference and re-use.

Both rings -Ring 2A and 2B – are in need of the services provided by the central one – specialist expertise and advice. The stakeholders acknowledge the need to create and sustain training incentives and opportunities addressing the information specialists. This should become a future commonly acknowledged agenda. With a few exceptions (mostly in USA), at this moment there are no designated educational structures to form specialists. It is the task of all stakeholders to provide a common approach and to form partnerships leading to a contoured educational framework.

These two circuits are fuelling the digital collection universe and through shear numbers of resources that are becoming more co-dependent we may safely say that a new type of heritage forms – a digital heritage that in many forms is much more affected by the time[22].

We should take a look at the areas of responsibilities in which these specialists are evolving.

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20 Harold Borko (1968). *Information science: what is it?* Available at http://www-ec.njit.edu/~robertso/infosci/whatis.html

21 Organisation for Economic Co-operation and Development (2006). Digital Broadband Content: Public Sector Information and content.(Final Report). Available at: http://www.oecd.org/dataoecd/10/22/36481524.pdf

22 UNESCO Charter on the Preservation of the Digital Heritage (2003). Available at http://portal.unesco.org/ci/en/files/13367/10700115911Charter_en.pdf/Charter_en.pdf

Illustration 2: Response areas

There are four big areas where the new profiles need to find the proper responses:
- – Management (financial, business models and project tracking),
- – Technology (software, hardware, formats),
- – Access (design, IPR and copyright, advocacy) and
- – Work flow (digitisation, data curation, quality control).

These four areas should be considered as complementary to each other. They form a possibly integrated environment for the skills and abilities needed by the future professionals. They also exhibit the possibilities of specific separation of skills and abilities as well. It must be stressed that a formulation for a possible curricula or training programme should be a calibrated response to the oscillating needs expressed in every practitioner's institutional environment.

The requirements pushing LAM practitioners to cross the boundaries of their base specialisation should be balanced in favour of interdisciplinary adapted responses. This is because none of them really belongs to a certain field any more and this certain aspect should be reflected on curricula and training. A look at the job adverts reflects clearly this need.
This fragmented reality is evolving in the context of understanding that the user's needs have to be situated in the centre. It becomes more and more counter-productive to think about the services for dissemination as separated realities by the particularities of the institutional profiles existing in the framework of LAMs.

Summary:

All stakeholders are in need of expertise for managing increasingly volumes of data and information.
There is a need for better contextualisation and visualisation tools to go along with the expertise.
The power of future progress of the institutions with a role in information management are professionals able to find, collect, organise, store, curate, retrieve, interpret, transmit, transform, and use the information.
The stakeholders acknowledge the need to create and sustain training incentives and opportunities addressing information specialists.

4. The LAMs – a cradle of change

It would be very useful to remember a thing related to the user's perspective when it comes to access: for it is no matter of concern where the information comes from as long as access is provided to it.

Michele Doucet (Libraries & Archives of Canada) described the user's experience as supported by " an integrated, one stop access layout, with a reference model that basically works like a triage system in an emergency room. All visitors come to one location where their specific request and level of need are quickly assessed."[23] This is an example of how nowadays LAMs should establish multiple bridges across on all professional levels and meet the user's needs.

The relevance of putting the beneficiary amid all efforts regardless of the institutional background is also stressed out in the resulted study from the discussions upon the future shape of the EU LIS curriculum: "from the user point of view, collaboration between memory institutions brings multiple benefits because it destroys artificial barriers posed by different formats and provides a holistic view of human knowledge preserved in libraries, museums and archives."[24]

In Anna Gold's paper there is a reference to an FAQ[25] in support for beneficiaries of the National Science Foundation funding: *we believe in user/use-centered design. We also believe that librarians, archivists, and computer/ Computational/information scientists are unlikely to build excellent infrastructure for science and/or engineering without deep engagement with the intended users. In that sense, domain scientists should be full partners in the process.*

On many levels it comes to a different approach concerning the organisational culture change. A new interconnected management set related to digital content for the stakeholders who offer access and meaningful context to their information is needed.

LAMs are often coming together more easily when they are integrated in the same electronic informational structure. Also, the most important component involved in the evolution of LAMs is true collaboration which "inevitably and fundamentally involves change. Collaboration is transformational and the elements, institutions and individuals involved in collaboration must change." (Ken Soehner, Chief Librarian at the metropolitan Museum of Art Thomas J. Watson[26]).

It is relevant to cite from the same report the following: "a collaboration in which campus LAMs agree to utilise a central trusted digital repository to safeguard digital assets for the long-term creates deep dependencies as well as tangible economic rewards. As units reorganise their flows and policies around the shared capacity, they discover new ways in which to leverage their combined assets, and overtime realise the transformational quality which is the hallmark of deep collaboration."

There is also another formulation for LAMs which is circulated in Europe as "memory institutions". Memory institutions is a denomination that has been accepted by all the professionals working in

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23 Diane M. Zorich, Günter Waibel and Ricky Erway (2008). *Beyond the Silos of the LAMs: Collaboration Among Libraries, Archives and Museums*. Dublin, Ohio: OCLC Research. Available at http://www.oclc.org/research/publications/library/2008/2008-05.pdf

24 Zinaida Manžuch, Isto Huvila and Tatjana Aparac-Jelusic. Digitisation of Cultural Heritage. In Leif Kajberg, Leif Lørring (2005). *European curriculum reflections on Library and Information Science education.* Copenhagen: Royal School of Librarianship and Information Science, 37-60

25 http://www.nsf.gov/pubs/2008/nsf08021/nsf08021.jsp#pctb

26 http://www.oclc.org/research/publications/library/2008/2008-05.pdf

the respective fields and it seems this is because it also implies maintaining of the internal borders set by the different practices in some ways. "Despite «memory institutions» being a buzzword in professional and academic literature there is still a lack of an in-depth studies on the perspectives of convergence and/or networking of archives, libraries and museums" - EU LIS. This is the European view but there are also different opinions like the one presented by Robert S. Martin[27] from the Institute of Museum and Library Services: *The point is simply that the distinction between library and museum and archives that we now accept as common is really a matter of convention, a convention that has evolved over time. That convention is predicated on a perception that libraries and museums collect very different kinds of things. In fact, however, from one perspective or frame of reference—one school of thought—libraries, museums and archives all collect precisely the same things. They all collect documents.*

A good example to illustrate how higher grounds of collaboration are created would be The Museums, Libraries and Archives Council[28] in England that is a Non-Departmental Public Body (NDPB), sponsored by the Department for Culture, Media and Sport (DCMS). It is acting as a ***strategic body working with and for the museums, archives and libraries sector, tapping into the potential for collaboration between them***, *MLA replaced the Museums and Galleries Commission (MGC) and the Library and Information Commission (LIC).*

A similar body this time in United States of America is the Institute of Museum and Library Services based on Museum and Library Services Act. The institution seems decoupled from the archives having the mission limited to steward the cultural heritage, information and ideas. The archives stay with NARA – National Archives and Records Administration. The situation changes a bit further on the North in Canada, where we have Library and Archives Canada, a body that combines the collections, services and staff of the former National Library of Canada and the former National Archives of Canada, based on Library and Archives of Canada Act, but this one seems decoupled from museums instead.

4.1 Points of convergence

Where do these practices converge and what should be the starting point for a space that will realise a needed singularity in terms of vision and practice coordination?

This question is brought by the need for offering the user the best possible response to his informational needs. This space is formed partially by different project based cooperation, but even so, there are a lot of differences in vision, let alone the practices.

The articulation of such a space is forced by the information and communication upheaval. Users, being also those who are entitled to access the best knowledge body that information actors have to offer, are not interested in understanding the differences between the different bodies and communities of practice. They are usually interested to satisfy their needs with the minimum of effort and on the spot.

Realistically speaking, a complete convergence will not occur on the medium term, but there are two concurrent levels of involvement of the bodies inside LAMs to be observed: one that keeps a clear separation, due to the fact that they still manage assets in traditional form having also different social roles which entail techniques and practices that cannot be easily bridged, and the other level being the collaborative one usually project-driven that is pointed towards pooling resources in the data collections universe.

27 Robert S. Martin (2003, August). Cooperation and Change: Archives, Libraries and Museums in the United States.
    World Library and Information Congress: 69th IFLA General Conference and Council. Berlin
    http://archive.ifla.org/IV/ifla69/papers/066e-Martin.pdf

28 http://www.mla.gov.uk/

There is an interesting converging point between the conclusions drawn in the report submitted to JISC by Alma Swan and Sheridan Brown and the OCLC study about the LAMs. This points to the professionals involved and brings to light some particular aspects:

– The experts managing data gradually traverse the boundaries of their base specialisation and slowly are turning into data scientists;
– They have their scholarly roots in one domain but they tend to open and embrace adjacent fields quickly usually following the institutional needs of solving information management situations;
– They do not have a clear career path and are easily caught on the border of different many little data managing crisis;
– They find it difficult to retain a feeling of continuous build-up of skills as the opportunities for training are rare or the funding in these regards is scarce;

Today many involved specialists in the life and evolution of digital repositories understand in a holistic manner the life-cycle of digital objects and they may lead the way to establishing a common view through bridging across practices.
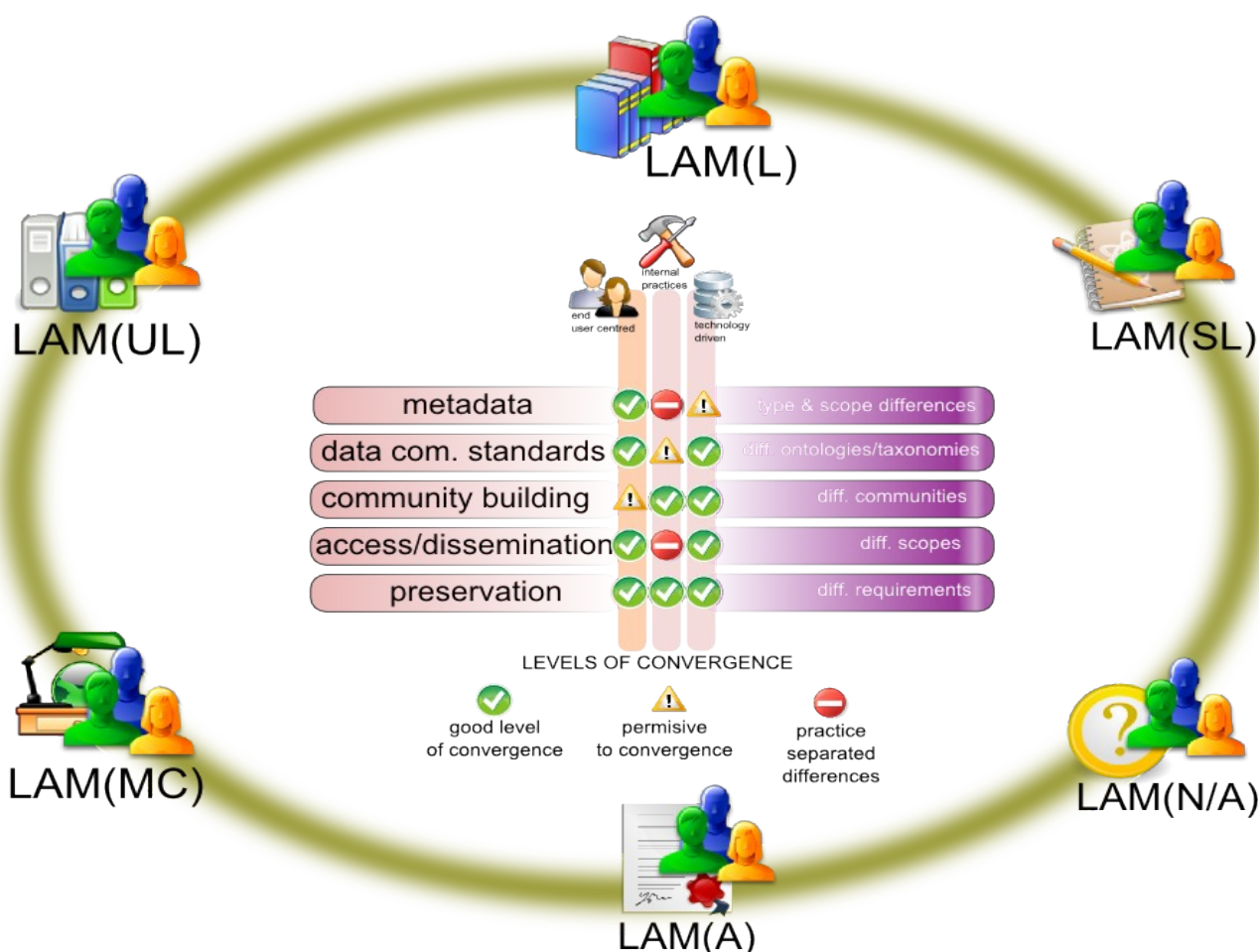

Illustration 3: Levels of convergence

The reality is influenced by the fact that dedicated structures managing data and electronic collections inside LAMs are few in numbers. If there are services put in place to such purpose, these are at best working on project bases, having no perspectives with regard to future preservation or life-cycle policies for the collections. There are many exceptions, but the average is described as

such. Because of the lack of sufficient awareness, at this point, LAM specialists should fill the gap by skilling up and present themselves to their patrons as an evolved body of expertise and knowledge.

There are some levels of convergence as it is seen in Illustration 3 where specialists from different LAM fields (Public *L*ibraries«L», *U*niversity *L*ibraries«UL» – research libraries, *M*useum *C*urators«MC», *S*pecialised *L*ibraries«SL», *A*rchives«A», etc.), share some commonalty but there are more levels to be covered in order to realise a common space.

The best solution available seen in practice is the collaborative road chosen by the actors in LAMs arena in order to establish future *digital data commons[29]*. That means establishing elements of infrastructure that work in harmony mostly in joint dissemination activities. In this context, the expertise LAMs are packing becomes a real bridging potential towards establishing articulated and user oriented responses. On the technological level the most complete expertise is concentrated in university research centres, data centres and different bodies that offer externalisation services, but opportunities should be devised to ensure a large diffusion of practices and qualifications also to LAM specialists via training and continuous professional development joint programmes. Resorts should be envisaged mostly because, in the end, they represent the opportunity to evolve into a different kind of institutional profile capable of offering proper answers.
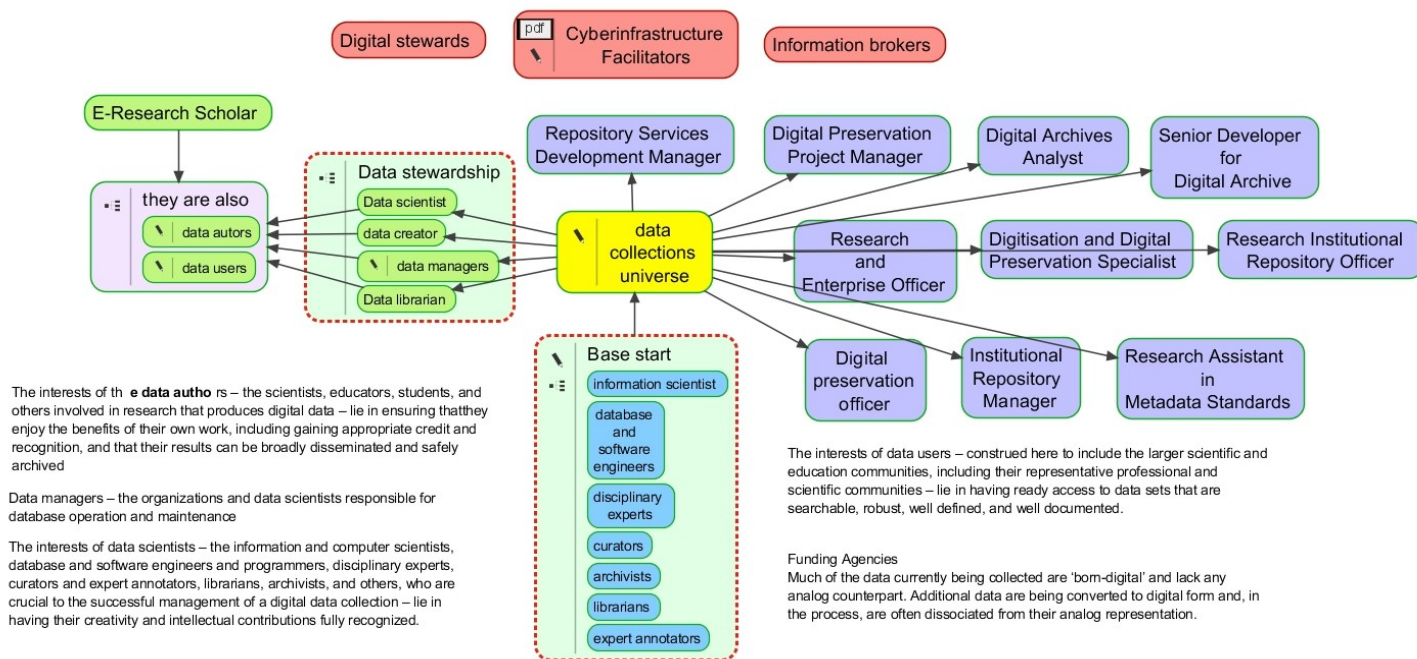

Illustration 4: Different roles in data collections universe

One of the most integrative vision for the future of LAMs is offered by the European Council Conclusions on the Digitisation and Online Accessibility of Cultural Material, and Digital Preservation in 2006. Here, the Council recognises the roles of different institutions and bodies all over EU in getting more close to accomplish the dream of creating the European Digital Library, but underlines the direction *towards the goal of achieving a balanced cooperation between libraries, museums and archives*.

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29 National Scicence Board (2005). *Long-Lived Digital Data Collections Enabling Research and Education in the 21st Century.* National Science Foundation. Available at http://www.nsf.gov/pubs/2005/nsb0540/

The interim report of the Netherlands Coalition for Digital Preservation builds upon a survey in three distinct sectors: scholarly communications, government&archives, and culture&heritage. An important conclusion drawn is that, with regard to cooperation, the responses vary from underlining differences across sectors resulting in occasional benefits to a feeling of closing more tightly:

> *The question of authenticity, for example, used to be an archivist's problem only. Now libraries, too, have to make sure their migrated content is still representative of the original file. The records continuum theory developed by the archival community can inspire data management both in the research community and cultural heritage institutions. The research community, on the other hand, has made the best advances in building distributed networks and promoting interoperability by means of persistent identifiers which prevent internet content from being lost.*

Recently, NCDP published the Strategic Agenda 2010-2013 for Long-Term Access to Digital Resources[30] where *cooperation and collaboration* is put on the centre of future network-driven efforts. This network approach puts in a new light the stakeholders that will rally facilities and services around leader's (institutions) decisions – *the leaders assume the role of facilitators*.

Another important vision that points towards a complete convergence comes from Sheila Corrall, The Information School, University of Sheffield
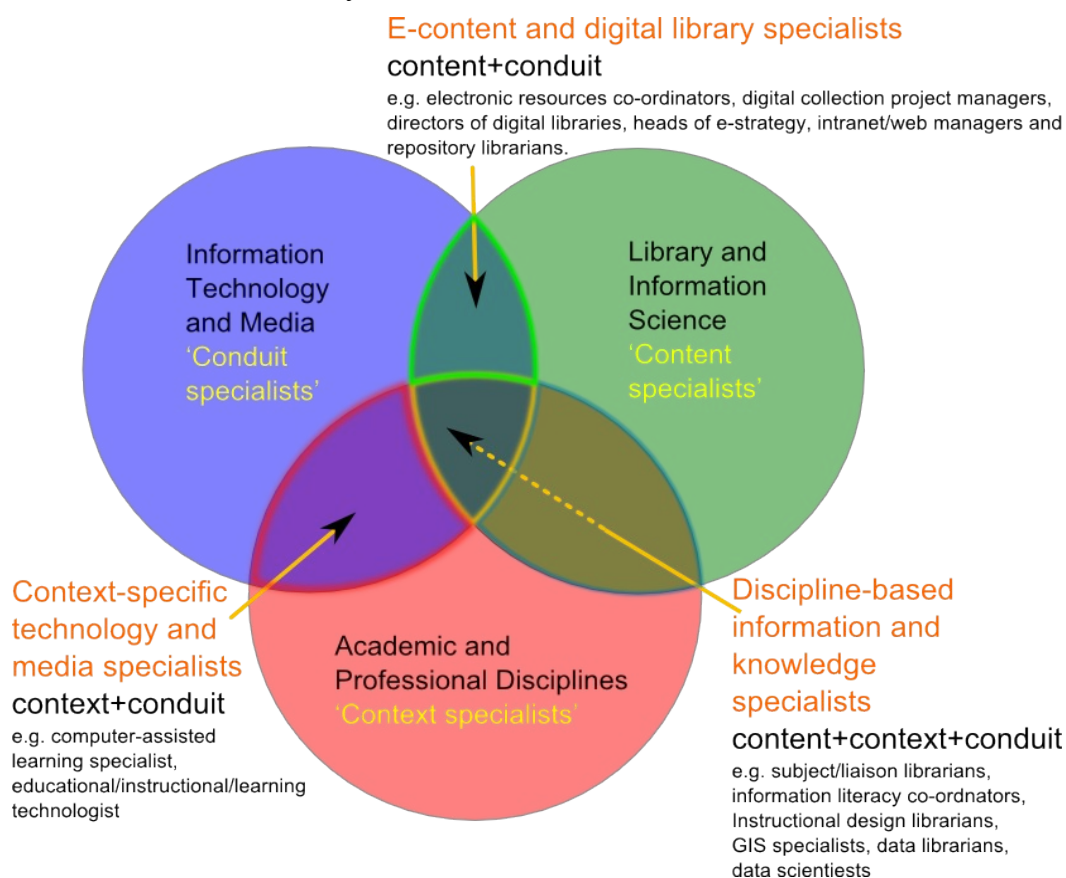

Illustration 5: Sheffield model of blended information professionals (Sheila Corrall)

Although the accent is put on the library and the future of librarianship in its continuous shift, the idea of the "blended professional[31]" entails levels of *hybridisation* that delivers in the end a model

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30 http://www.ncdd.nl/en/documents/10-13strategicagendaNCDD_EN.pdf

31 *An academic librarian who combines the traditional skill set of librarianship with the information technologist's hardware/software skills, and the instructional or educational designer's ability to apply technology appropriately in the teaching-learning process* - Bell, S.J. and Shank, J.D. (2004). *The blended librarian: a blueprint for redefining the teaching and learning role of academic librarians*. College & Research Libraries News, Vol. 65 No. 7, pp. 372-

of blended information professionals.

4.2 On the shores of the Atlantic

In order to have a perspective it would be appropriate to take a look on what possibilities are opened for those interested in looking beyond today information specialisations. The most visible in this context are the so-called iSchools in the United States of America and in Europe, with exceptions (UK and Germany), which are mostly project outcome efforts, the shape of the educational field of information science looks fractioned at best.

There are two examples that were chosen for how they understand to prepare the future professionals in information field:

4.2.1 Sampling North America and beyond

It is worthwhile to start taking a look at the iSchools – a denomination for Schools of Information, that have training programmes designed to streamline information technology, library and information science and informatics into a unique, interdisciplinary effort to generate a homogeneous relationship between information, people and technology. Right now there is an organisation composed of these iSchools that succeeded in bringing under the same charter 27 universities all over the world in what is called iSchools Caucus[32].

University of Illinois Graduate School of Library and Information Science with its Master of Science: Specialisation in data curation. The Data Curation Education Program (DCEP)[33] is ALA-accredited master of science offering insight on data collection and management, knowledge representation, digital preservation and archiving, data standards, and policy.
Highlights:
- Foundations of Information Processing in LIS,
- Document modelling
- Information modelling
- Metadata in theory and practice
- Information storage and retrieval
- Electronic publishing
- Preserving information resources
- Information transfer and collaboration in science

School of Information Studies – Syracuse University
The Master of Science in Information Management with Data Management Specialisation of Study is of great interest, as it offers competence to the students with regard to managing and presentation of data including *relational and object-oriented approaches to archiving, retrieving and protecting information, as well as web-based user interfaces and geospatial information systems*.
Highlights:
Web design and management,   Database management,

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375. Available at: http://www.ala.org/ala/mgrps/divs/acrl/publications/crlnews/2004/jul/blendedlibrarian.cfm

apud Corrall, S. (2010). Educating the academic librarian as a blended professional: a review and case study. Pao Yue-kong Library. Hong Kong. Available at: http://repository.lib.polyu.edu.hk/jspui/handle/10397/1731

32 http://www.ischools.org/

33 http://www.lis.illinois.edu/academics/programs/ms/datacuration

Research techniques for information management,
Information system analysis,
Data mining,
Data warehousing,

Theory of classification and subject representation,
Data administration concepts and database management,
Designing web-based database systems.

These examples are given to catch a glimpse of how the trends will finally shape up a profile for the future professional or it will spawn a complete different bread of professionals needed to manage the digital landscape.

More insight into the future of such programmes that prepare the information specialists, a good resource offers WISE – Web-based Information Science Education. WISE presents a collaborative model based on three pillars: Quality, Pedagogy and Collaboration. WISE is in fact a consortium (http://www.wiseeducation.org/) of universities that have leading schools in the information field.

Let us take a look at a few highlights:
- Administration and Use of Archival Materials
- Advanced Database Management
- Applied Information Security
- Audio and Visual Information Sources and Delivery
- Bibliographic Organisation
- Cataloguing & Organization of Digital Resources
- Data Administration Concepts and Database Management
- Digital Libraries
- Distributed Computing for Information Professionals
- Electronic Publishing
- Government and Information
- Globalization and the Information Society: Information, Communication & Development
- Indexing and Abstracting Systems and Services
- Information Architecture for Internet Services
- Information Quality: Principles & Practice
- Introduction to Archives Management
- Introduction to Records Management
- Introduction to Strategic Information Management
- Law (Legal Resources)
- Licensing for the Information Professional
- Management and Administration for the Information Professional
- Management of Library Services
- Metadata
- Reference and Information Services
- Research Methods
- The School Library Media Specialist
- Topic Maps
- Use and Users of Information
- Web Design and Architecture
- Wireless Interactive Communications
- XML for Libraries

Another interesting stop is the collaboration between two curriculum development projects[34] in the United States. One – Digital Library Curriculum Project – is developed by the University of North Carolina at Chapel Hill School of Information and Library Science (SILS) and the Virginia Tech Department of Computer Science and the other one – Digital Curation Curriculum Project – involving SILS once again and NARA – US National Archives and Records; on short DigCCurr[35].

The goal of the project is to offer a *curricular framework, course modules, and experiential components to prepare students for digital curation work in a wide variety of environments*. DigCCurr I (2006 - 2009) was intended to foster and build an evolving, international network of leading digital curation educators as well. In this context, a six-dimensional matrix of digital

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34 Jeffrey Pomerantz, Sanghee Oh, Barbara M. Wildemuth, Carolyn Hank, Helen Tibbo, Edward A. Fox & Seungwon Yang (2009). Comparing Curricula for Digital Library and Digital Curation Education. In Helen R. Tibbo, Carolyn Hnak, Cristopher A. Lee & Rachael Clemens (Eds.), *Proceedings of DigCCurr2009: Digital Curation. Practice, Promise & Prospects* (pp. 2-3). North Carolina: University of North Carolina at Chapel Hill. Available at http://stores.lulu.com/DigCCurr2009

35 http://ils.unc.edu/digccurr/index.html

curation knowledge and competencies were devised. The matrix is organised into six dimensions: 1) Type of Resource; 2) Functions and Skills; 3) Professional, Disciplinary and Institutional/Organisational Context; 4) Mandates, Values and Principles; 5) Prequisite Knowledge; and 6) Transition Point in Information Continuum. In collaboration with Digital Curation Centre and DigitalPreservationEurope DigCCurr project staff contributed to the development of the International Digital Curation Education Action Working Group (IDEA). The idea of the working group is to develop a shared digital preservation training infrastructure to enable reuse of training and education materials.

Starting with DigCCurr II (2008 – 2012) the studies were extended to Doctoral Studies and Practitioners. A great achievement of this project should be pointed out: the development of a taxonomy of functions and skills.

Highlights:
Master of Science in Information Science

Information Tools,
Human Information Interactions,
Information Retrieval,
Organization of Information, Systems Analysis,
Management for Information Professionals,
Research Methods, Master's Paper,

Understanding Information Technology for Managing Digital Collections,
Electronic Records Management or Digital Libraries: Principles & Applications,
Digital Preservation and Access.

Master of Science in Library Science

Information Tools,
Human Information Interactions,
Information Resources & Services,
Resource Selection & Evaluation,
Organization of Information,
Management for Information Professionals,

Research Methods, Master's Paper,
Understanding Information Technology for Managing Digital Collections,
Electronic Records Management or Digital Libraries: Principles & Applications,
Digital Preservation and Access

Both of the projects address the issue of the life cycle of digital objects from different perspectives, being concentrated on different parts. A degree of overlapping of modules and units is acknowledged, but as both target to form the future professionals that manage digital collection universe, a degree of collaboration make it essential to achieve the optimal results.

There is a project – Closing the Digital Curation Gap[36] (2009 - 2011) – that aims to bridge the Atlantic shores "establishing a baseline of digital curation practice/knowledge, especially in small to medium-sized cultural heritage institutions in the US and UK". This project, financed by JISC[37] and IMLS[38] will "produce selected tools for the target communities such as guides to good practice, decision trees, and Digital Reference Manual chapters; Plan for future collaborative projects based on what we learn from this initial endeavour; and lay a foundation that will inform future training, education, and practice."

The activities of the project offer a contour of a possible future requirements for the digital steward:
- *creation of high-quality digital surrogates and originals selection and acquisition of existing digital assets*

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36 http://www.dcc.ac.uk/projects/closing-digital-curation-gap

37 Joint Information Systems Committee is an advisory committee to the funding councils in United Kingdom

38 Institute of Museums and Library Services works at the United States of America national level and in coordination with state and local organizations to sustain heritage, culture, and knowledge; enhance learning and innovation; and support professional development.

- *creation of metadata for discovery, management, interoperability and preservation*
- *managing intellectual property*
- *managing other rights to access and use*
- *digital collections file format identification and management*
- *managing archival storage environments migration of content over time.*

Summary:

For the user, the institutional profile doesn't matter as long as access is provided to resources.
LAMs are coming together more easily if they find themselves as being integrated into common electronic informational structures.
A space to realise a singularity in terms of vision and practice coordination is needed to become reality within LAMs.
LAMs should open wide to institutional change brought by the skilled up personnel.
Many studies emphasize the shared capacities deployed as network-driven efforts.
It is visible that in North America the convergence of LAM disciplines is picking up speed and much of the efforts are

5. The European level

Europe presents itself as a reality, having different levels of development related to LAM disciplines convergence. We may say there are some very concentrated points, like the various projects running in the United Kingdom or Germany. But the main research activities in the field run on pan-European level via different projects funded through specific instruments, like the Seventh Framework Programme of the European Community for research and technological development, *e*ContentPlus, etc. One of the interesting aspects of the European space, which produces unique effects I,s that although policies concerning digital content preservation were devised, the Member States adapt their own sets of policies to the needs of their national environment. Localised practices are run against various recommendations issued by the different official bodies of the European Union.

The most important aspect of all these projects run in the EU is that LAM specialists are presented with a possible context of becoming fully-fledged digital stewards. This context is formed by the training opportunities that many projects offer, provided the specialists are able to attend them. These moments, unique in their purpose and strongly desired by the information market job on the long run, are in fact the cradle for more intimate changes within the information specialist community. They are the incentives to provide the knowledge, skills and abilities for all those interested as they stride for presenting the state of the art in the field and solutions to different issues.

5.1 Evolution of the EU digital preservation policy documents and future responsibilities for those managing the cultural and scientific heritage

LAM specialists in Europe are collaborating to bring the rich cultural and scientific heritage to the users. European institutions offer incentives to the stakeholders to develop networks for collaboration and appropriate instruments to facilitate access. Many projects supported through various funding instruments entail preservation of the digital content being generated. In order to

understand how digital preservation is shaped, we have to follow the policies and recommendations addressed to the Member States.

The first acknowledgment of the need for digital preservation came with the Lund Principles – document that established the priorities *to add value to digitisation activities in ways that should be sustainable over time.* The vision also reflected in the Action Plan was to avoid a "digital dark ages" by developing advanced research agendas into digital technologies and preservation of content.

The Council's Resolution of 25 June 2002 on preserving tomorrow's memory — preserving digital content for future generations acknowledges *that memory institutions such as archives, libraries and museums have a central role to play* in preserving the cultural and intellectual assets that are held in public collections and in the possession of private actors, as well. There is also a note to the need of creating LAM networks with a stress on *the need to continue to develop methods and guidelines for long-term preservation*. Also an important highlight is to be found in that the Council proposes naming LAMs as custodial organisations. Of the utmost importance is the *improvement of the skill base, by creating mechanisms for the exchange of knowledge and skills, and for the ongoing identification of emerging skills requirements and training needs*.

Communication i2010: Digital Libraries, COM(2005) 465 final[39] contains a section dedicated to preserving digital content from which it worth highlighting the following: "*its impact goes far beyond the realm of libraries and archives and concerns all organisations producing digital information and interested in maintaining its availability*[...]"

This is to be considered also the first step towards creating *a virtual European library*. Besides the definition of the digital libraries, the document makes the case of the information originally produced in a digital format (scientific information) and stored in digital repositories so *both aspects – digitised and born digital material – are covered by this initiative*. So, there are two key-areas in the scope of EC: cultural heritage and scientific information. One of the conclusions is that digitisation without a proper preservation strategy can turn into a wasted investment, and this in the context of the urgent need for addressing these pressing issues by the politicians and institutions alike.

The document poses an important issue concerning *who decides and who is responsible for preserving what?* It is here where the duplication of efforts and of divergent approaches are acknowledged. Also, *preserving digital information also requires new ways of working. This includes upgrading the skills of staff as well as more collaboration between public and private players.*

The public consultation was followed by a Recommendation in August 2006 to the Member States to *establish national strategies for the long-term preservation of and access to digital material, in full respect of copyright law*. The document recommends *making provision of web-content by mandated institutions using techniques for collecting material from the Internet such as web harvesting, in full respect of Community and international legislation on intellectual property rights.*

In 2007 the European Commission signalled the launch of a policy process on (a) access to and dissemination of scientific information and (b) strategies for the preservation of scientific

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39 http://ec.europa.eu/information_society/activities/digital_libraries/doc/communication/en_comm_digital_libraries.pdf

information across the Union. This should be seen as a slight move towards stressing the role of preservation in the context of the well-known by now issues: organisational, legal, technical and financial. There is an aspect that should be put under observation as this keeps repeating: *there are currently no clear strategies in place across the Union for long term preservation and usability of digital scientific information. Existing national and European initiatives must be linked systematically.[...] Moreover, a successful public preservation strategy requires good collaboration between public and private partners.*

This *Communication on scientific information in the digital age: access, dissemination and preservation* also contains some very important questions that the information scientists must answer:

Who is responsible for preserving research data and the necessary software and hardware?
What are the roles of research organisations and libraries?
According to what criteria should the material to be preserved be selected?

The Commission took another step further and set the Member States' Expert Group on Digitisation and Digital Preservation. Its role is *to provide a forum for cooperation between Member State bodies and the Commission at European level and to exchange information and good practices of Member States' policies and strategies on the digitisation and online accessibility of cultural material and digital preservation.* The most important outcomes were presented by the members in the Final Report on *Digital Libraries: Recommendations and Challenges for the Future[40]* in 2009.

Taking a look at the *Council Conclusions on scientific information in the digital age: access, dissemination and preservation*, the slight separation is repeated: *effective and long-lasting digital preservation of scientific information is fundamental for the current and future development of European research.* The document reveals that preservation issues are, from now on, biased towards research output and lesser on cultural material. The Council underlines *that policies and practices in the Member States on access to and preservation of scientific publications and research data are developing at different speeds* and takes note of *the intention of the Commission to support further research on the scientific publication system, and to carry out a study on the economic aspects of digital preservation*. Member States are invited to reinforce their national strategies with regard to preservation and dissemination of scientific information and enhance co-ordination between Member States, large research institutions and funding bodies. A path is not to be seen from this point forward as the Council recommends that the Commission should *encourage research into digital preservation, as well as experiments on and wide deployment of scientific data infrastructures with cross-border, cross-institution and cross-discipline added-value for open access to and preservation of scientific information.*

In the Communication "Europe's cultural heritage at a click of a mouse", the Commission put more stress on the issue of absence of some clear and comprehensive policies, still seen in the Member States. The problem of born-digital material is taken into consideration as well. Many of the conclusions of this document with regard to preservation are drawn from the *Implementation of the Commission Recommendation on Digitisation and Online Accessibility of Cultural Material and Digital Preservation* – two rounds of reports (2008 and 2010) sent by the Member State's representatives to the Expert Group on Digitisation and Digital Preservation[41]. Focus is put on 5 areas of interest:

  – Progress in national strategies for the long-term preservation of and access to digital material;

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40 http://ec.europa.eu/information_society/activities/digital_libraries/doc/hleg/reports/hlg_final_report09.pdf

41 http://ec.europa.eu/information_society/activities/digital_libraries/experts/mseg/index_en.htm

- Progress in the exchange of information with other Member States on your strategies and action plans;
- Progress in legal provisions for multiple copying and migration of digital cultural material by public institutions for preservation purposes;
- Progress in policies and procedures for the deposit of born-digital material;
- Progress in legal provisions for the preservation of web-content by mandated institutions.
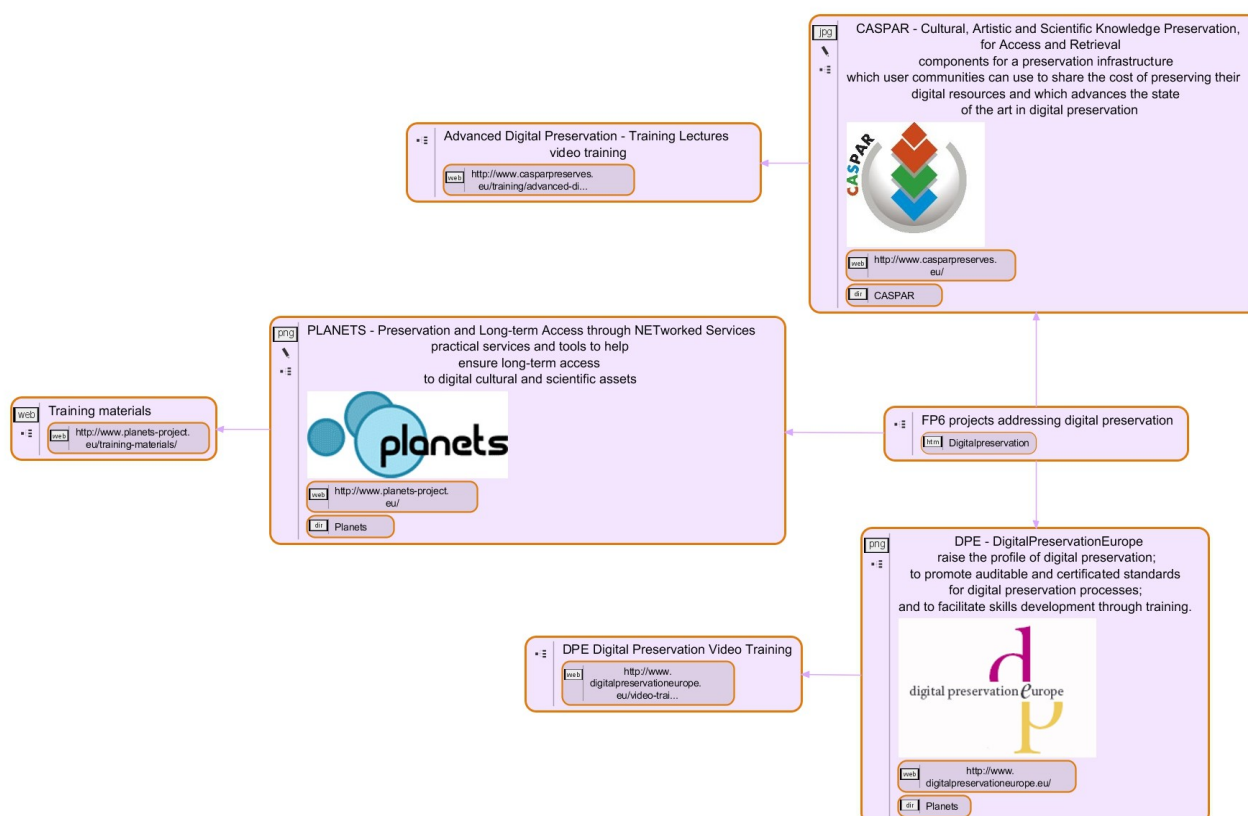
As a conclusion to this short incursion on the European policy level, there is a need for the Member States to adopt national strategies accompanied by concrete action plans.

Also, straight answers should be given to the questions asked in the *Communication on scientific information in the digital age: access, dissemination and preservation.*

The answers to these questions are embedded into the experience of LAM professionals and they should be the ones to take a step forward in answering naturally based on their good practices in managing data, information, knowledge and most important being the ones who lead their users towards achieving awareness and contributing back evolving the spiral as such.

5.2 Answers on the European level

It becomes clear that when it comes to digital preservation, the accent is put on the role and the associated responsibilities of national and research libraries. Also, there is a more contoured path towards preserving scientific information[42] ("records of science"), leaving the "cultural material" - subject to the same needs of preservation - to be understood as an internal reality of the digital
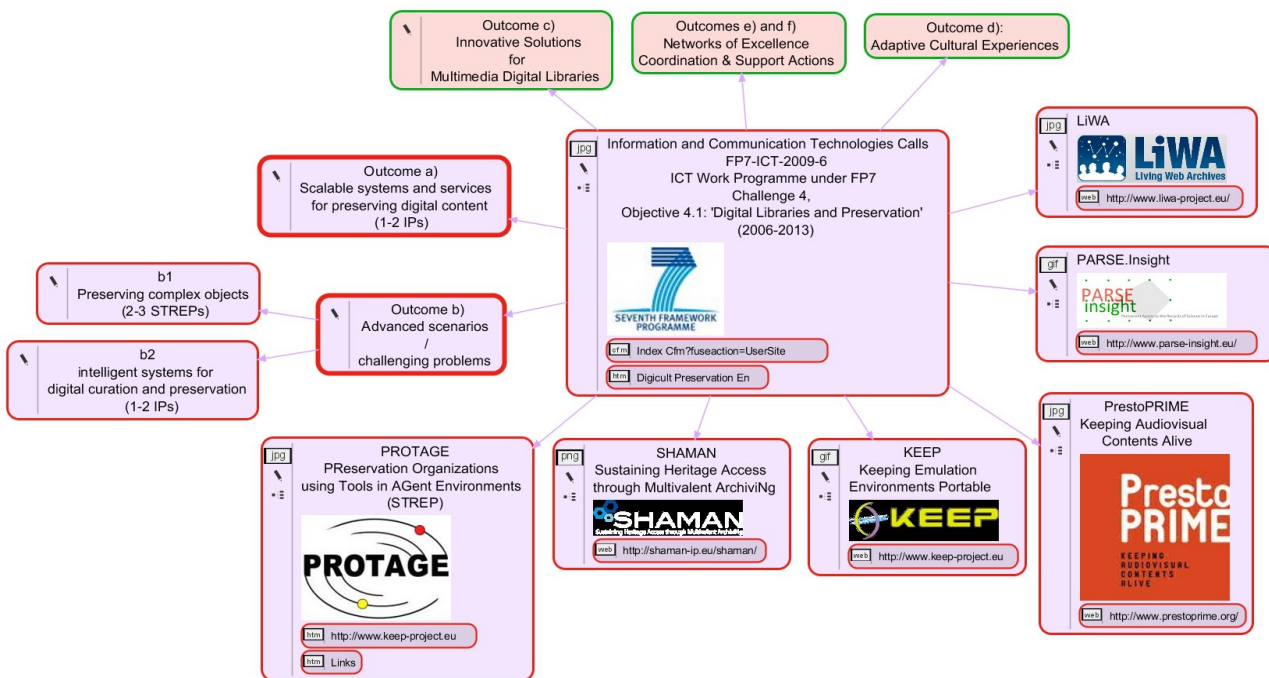

Projects addressing digital preservation developed during FP6

42 High Level Expert Group on Digital Libraries (2009). *Digital libraries: Recommendations and Challenges for the Future*. [Final Report]

library's work flow. The cultural heritage reflected through the cultural material at times poses very complex digital preservation scenarios, as they form complex structures. Text, image, sound, video footage and compound media objects, and more often embedded code sequences, come together to form aggregated content with specific meanings to users. This separation is also pointed out as well in the Strategic Action Plan[43] of the Alliance for Permanent Access. UNESCO's Charter on the Preservation of Digital Heritage[44] shows the records of science integrated into a digital heritage outputted by scientific profiled institutions which preserve the records of science in the enlarged context of scholarly communication.

During Sixth Framework Programme for Research and Technological Development a number of projects were funded to form a solid knowledge base in support for digital preservation. CASPAR, planets, Digital Preservation Europe and DRIVER are only a host of them. One important aspect is that these projects also produce effects on the educational and advocacy level. Each one of them have a training component which proves to be instrumental for those who do not have direct access to specialized events and training sessions opportunities.

FP7 digital preservation landscape

Starting with the Seventh Framework Platform for Research and Technological Development, the number of projects addressing segments of digital preservation grew and split to cover better defined segments as it is seen in the illustration above. These projects are in development and, with a few exceptions, there are no training extensions attached. There are two more projects that have to be taken into consideration as they address the preservation of science research output by building efficient electronic infrastructures and services: DRIVER&DRIVERII and OpenAIRE.

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43 http://www.alliancepermanentaccess.eu/Strategic%20Action%20Programme.pdf

44 http://portal.unesco.org/ci/en/files/13367/10700115911Charter_en.pdf/Charter_en.pdf

5.3 A need for better knowledge transfer and training

Due to the fact that European Union is presenting itself as a mosaic, there is another level that has many ramifications and where progress is to be seen more often, localised on different solutions: the national initiatives and synergies established between related projects. Those are presented in more detail in the two rounds of surveys taken by the Expert Group on Digitisation and Digital Preservation in 2008 and 2010.

Also, there is an underlying need for localised, possibly national established training channels because it is obvious that within EU there are discrepancies coming out of the finance limitations and many times lack of national policies.

Even though web dedicated services exist (content management systems, blogs, wikis, open access journals, etc.), there is a problem related to time limitations on both sides: knowledgeable specialists (evolving as trainers) and those who really need to receive training. The body of knowledge presents itself as a discrete corpora of information, and one needs guidance to be able to follow a productive path. There is a strong need for aggregation services, to make the transfer more efficient in terms of usability, authenticity, discoverability and accessibility. There is also a need for better knowledge transfer beside the solutions at hand – parsing specialised literature, attending occasional training courses[45] and specialised events participation[46]. Some studies demand more often for the stakeholders to convene on national or global levels, in order to tackle the demand for data management education and training. A future path would be the *embedding preparation for a professional (and personal) lifetime of digital curation within the academic curriculum[47]*.

A good example is wePreserve[48] a f,orum *to serve as a common entry point to digital preservation and curation projects.* But the most important aspect is that it enables a collaborative channel for *development of training and educational activities, events and programmes in Europe.* A practical example would be the DPE/Planets/CASPAR/nestor Joint Training Events, that contributed a great deal of effort in establishing a training infrastructure.

Another solution would be to monitor the significant organisations, coalitions and associations spurred by different European projects or established on national level, which came to existence in order to address pressing needs in the field of information management and long time preservation. These organisations have the know-how and administrative and logistic means to become training facilities for trainers and also to transform themselves into clearing houses for policies, methods, techniques and good practices. Two examples of such outcomes: Open Planets Foundation (OPF)[49] and Confederation of Open Access Repositories (COAR)[50].

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45 DPE/Planets/CASPAR/nestor Joint Training Events

46 WePreserve Annual Conference

47 Graham Pryor and Martin Donnelly (2009). *Skilling up to do data: Whose Role, Whose Responsibility, Whose Career?* The International Journal of Digital Curation, 4(2). Available at
http://www.ijdc.net/index.php/ijdc/article/view/126/133

48 http://www.wepreserve.eu

49 http://www.openplanetsfoundation.org/

50 http://coar-repositories.org/

These examples are here only to emphasize the need for broadening the horizons. In order to be prepared, LAM specialists have to respond to a few essential questions that hold the future of information specialists and their continuous professional development:

- How to discover where my skills should be best matched with the evolving job market (data managers, data curators, science output curators, etc.)?
- From where do I start my training according to the future needs of the LAMs related to the new roles?
- How to answer the patron's and manager's questions whether my institution is able to manage and preserve research output?
- Am I ready to match the requirements of the science field I'm serving? Who or what may lead me to an answer?
- Am I capable to open the horizon in terms of answering the challenges my institution is facing?

Summary:

In Europe the convergence of the LAM disciplines is the effect of developing projects aimed at different types of users and communities.
The European policy is pushing for improvement of the skill base.
The digitisation of the resources without a proper preservation strategy translates into a wasted investment on the long run.
A harmonised copyright framework is needed in Europe.
With some exceptions there are no clear strategies across the Union for long term preservation and usability of digital scientific information.

6. What could a LAM specialist do with base training?

This question appearing more often, it reflects a need for a shift in the training paradigm, as necessities move towards the digital landscape. There are a few points where the nowadays librarian may be able to give a full positive "yes":

1. *Metadata creation and enhancement* many of the repositories out there, after a basic set of metadata, are introduced by the contributing authors and need a further refinement and enrichment in order to maximise relevance internally for the system and also for metrics assessment purposes[51].
2. *Mediators* where this is a common practice at a depositing stage or for making sure all the contributions stay in quality targets set for the content.
3. *Targeted information gathering* (reference services evolved): gathering information of specific interest to specific users, mapping information across networks.
4. *Publication and dissemination services* (they should take active roles in promoting the new means for publication and also opening opportunities for those who are in search of new distribution channels).

Possible short-term evolution:
1. *Connection Stewards* maintaining a link between the cultural heritage and their electronic representations – a continuous role of mediation and a guaranty of the authenticity. Capable of elaborating and maintaining maps of the electronic resources.
2. *Trainers* for the researchers to become more data-aware and playing an active role in disambiguation and debunking of particular aspects with regard to scientific and cultural contributions.
3. *Policy expert* for preservation and open exchange as well as for intellectual property issues.

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51 A DRIVER's guide to European repositories, pg. 39

4. *Cyberinfrastructure facilitators* (Oxford eResearch 2008)[52] - *these are information professionals able to partner with e-research teams to identify extant data and tools, as well as build new tools in pursuit of research topics*.
5. *Public Domain facilitators* as LAMs are established legitimate mediators, having the right profile for *public sector information* and *public content re-usage*[53].

6.1 The landscape of the near future

The landscape of library and information science schools and programmes is not a regular one, nor is presenting itself as a harmonised perspective. Instead, it is evolving on competitive bases but on the same time, has to bring solutions according to the needs of the information management. This brings many differences in practices and reflected in as many solutions as localised institutional contexts. There is not a clear unifying context for now, but new developments require a move to such a goal.

Anna Gold's highlights some aspects related to library's role in the *digital ecosystem*. She identifies three areas:

– Institutional leadership (many institutional actions by national leaders in library education and practice to secure a long-term role for libraries in acquiring the stewarding collections of scientific data.)
– Conceptual progress (evolved conceptualisation on how collections managed by libraries serve informational need in extended environments)
– Legitimacy (sense of legitimacy is emerging regarding *social* and *technical* roles supported by an *evolving formal curriculum*).

There is also another conclusion that says *the preservation of «data» had not emerged as a major concern of libraries* but it is easy to see that information scientists are *working to increase their own data literacy and awareness, and equipping themselves to provide educational and consultative services related to data management and curation to their students and faculty*. There is an interesting point here and it should be highlighted: *most libraries are unlikely to be in a position to curate major collections of digital data themselves*. This is true if funding is taken into concern and is one of the main reasons to fall back to the consortium scenario, but given time and understanding of the collaborative new paradigm, there is certainly a future for a new **space of** convergence.

Such a space for convergence could be drafted out of the Model Principles as they are shown for the research libraries, but given the progress, they apply to all LAM:

open access, open data, collaboration, digital stewardship & preservation, equitable service and support, professional development & Investment, metadata standards & metadata creation, virtual communities, sustainable models, communication.[54]

There is another point for LAM specialists to skill-up as digital stewards: a long line of selectivity developed at the core of their business. It is to be seen that such an ability proves useful in the

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52 R. David Lankes, Derrick Cogburn, Megan Oakleaf and Jeffrey Stanton (2008). Cyberinfrastructure facilitators: new approaches to information professionals for e-Research. Available at http://ora.ouls.ox.ac.uk/objects/uuid:392876bd-5d9f-40b0-822f-269332643e6b

53 OECD. Digital Broadband Content: Public Sector Information and content

54 ARL Joint Task Force on Library Support for E-Science (2007). *Agenda for Developing E-Science in Research Libraries*. [Final Report and Recommendations]. Available at: http://www.arl.org/bm~doc/ARL_EScience_final.pdf

following context. In the most recent White Paper[55] issued by Planets it is mentioned that *there is evidence that digital preservation is emerging as a profession in its own right; where previously the work was carried out by IT and preservation or curation staff, now it is starting to be carried out by specialists*. This conclusion was drawn from the on-line survey Planets conducted in 2009 to asses the state of readiness of the organisations interested in digital preservation.

Digital preservation comes with a very high price, that should come together with a policy according to long-life maintenance of the digital collections' universe. Due to the fact that we cannot preserve everything, it is in the end, the responsibility of those who will be skilled to make a meaningful selection of the material needed to continue a line of rich cultural and scientific background. And here LAM's nowadays specialists are yet the best chance we've got as they are trained to recognise value and preserve it.

Depending on factors such as the archival value and the use of a digital object as well as the resources available, a choice can be made at later migrations as to whether it is worthwhile to continue investing in it.[...] Preserving information in the digital age requires new ways of working. For efficient preservation organisational issues within the institutions will have to be addressed, such as upgrading the skills of the staff working in libraries and archives.[56].

Summary:

LAM specialists are able to cover many future roles by enhancing their base training skills and abilities.
LAM specialists need to establish a space of convergence where to acknowledge the common points and to bridge the differences.

7. Conclusions

The profile of the future information scientist could be determined if the institutional climate lets himself be changed by the benefits of collaboration. At this moment, we should expect a change in attitude on the level of the individual librarian, archivist, museum curator, information officer, information architect and every other profession that manages information. Information specialists should understand that "at every stage, collaboration can benefit from the presence of a «change agent» - a trusted individual, department or program that keeps the effort alive, injects it with a dose of resources (ideas, technology, staff) at the right time and keeps participants focused on the overall vision they are aiming to bring to life. Change agents think beyond red herring issues and offer possibilities for advancement. They are usually neutral parties whose ability to anticipate needs and present new ideas is highly valued.[57] " (Beyond the Silos of the LAMs).

As far as we are concerned as information science professionals, the question is: are we agents of change? Are we capable of developing a symbiotic co-existence in order to spawn the profiles of the information scientist? LAMs professionals have to make the switch to become information and data curators – a frontend meeting the real informational needs in research, education and leisure.

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55 Pauline Sinclair (2010). *The Digital Divide: Assessing Organisations' Preparations for Digital Preservation*. Tessella.
    Available at http://www.planets-project.eu/docs/reports/planets-market-survey-white-paper.pdf

56 http://ec.europa.eu/information_society/activities/digital_libraries/doc/communication/annex1_en.pdf

57 Zorich, Diana, Günter Waibel and Ricky Erway (2008). Beyond the Silos of the LAMs: Collaboration among Libraries,
    Archives and Museums. Report. Dublin, Ohio:OCLC. Available at
    http://www.oclc.org/research/publications/library/2008/2008-05.pdf

Both *information skills* and *information technology skills* are to be seen as the foundation of educational process that would lead a student or a lifelong learner into becoming the future professional able to manage digital assets.

It should be further acknowledged further that this new profile, this new figure that is brought into focus follows already a path (not always clear) towards a unified vision of the information science. Soon, there will be a time when all the distinctions will fade away and, most certainly, the needs of the users will set a different job market in this context.
The question is: are LAM specialists vectors of change, by recognising themselves as a branded guild ready to take on the digital world and regulate the informational deluge?

Information really needs context creation tools to spur real and useful knowledge-advanced environments: solid dissemination structures and tools to harvest the user's feedback and contributions. All this is highly time and resources-consuming. Here is the role of the information specialists, that is to separate the meaningful apart from the noise. What part of the information amount deserves the allocation of resources in order to become knowledge?

One facet of a possible future would be a real network of live communities free as much as possible from administrative chores and able to speak progress. LAMs should be the traps of explicit knowledge, they should ensure the dialogue and crystallisation of a common body of knowledge. More like nodes of aggregation than static knowledge dispensers.