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(1) Allaxia-Consiel
(2) National Museum of History of Sofia
(3) Naturhistorisches Museum- Prähistorische Abteilung of Vienna
(4) Museum für Vor-und Frühgeschichte of Berlin
(5) National Archaeological Museum Athens
(6) Budapest History Museum
(7) Comital Srl
(8) Euro Innovanet Srl
(9) Museo Nazionale Preistorico ed Etnografico L.Pigorini
(10) UIL
(11) Muzeul National de istorie a Romaniei of Bucharest
(12) University of Alba Julia "1 Decembrie 1918" University – Pre- and Protohistorical Research Centre
(13) Eddleston Innovation Ltd

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Title	**Building a virtual museum: reference patterns of professional skills, training requirements, social dialogue and equal opportunity in training strategies**

Abstract

EXECUTIVE SUMMARY

The report is part of the second phase of activity of the MUSEUM Project. It clearly defines the nature and character of the virtual museum, which it does in relation to other e-services and in particular to e-services delivered via the Internet. It then unpacks the objectives and goals of a virtual museum and examines their likely role in preserving knowledge, is dissemination in personalised and accessible formats and channels.

The main content of this report is to prepare the ground for MUSEUM partners to each begin piloting a virtual museum. It does this by analysing the functional profiles in a virtual museum pilot team and how such a team might work in relation to the parent museum. It identifies four key functional roles: project leadership, computing expertise, content expertise and web expertise. These functions are supported by seven areas of competence: photography, finance, e-learning, web designer, web developer and web manager and communications. These four major functions and seven support functions is not necessarily a full jobs, these are simply the function necessary to undertake the virtual museum project and are likely to be performed by recombining the function of existing staff and training.

The report details the Training Needs Analysis (TNA) approach to evaluating training needs for the project and suggests ways in which shared e-learning can support the virtual museum project.

The report concludes by summarising the potential beneficial impact of the project on equal opportunities and social dialogue.

INTRODUCTION, PURPOSE AND STRUCTURE

Online information channels especially the Internet and multimedia technologies are an important opportunity for public museums to widen their access and using e-learning to increase exposure to culture. The MUSEUM project is an EU-funded project aiming to help public museums migrate into virtual museums by supporting the training of professional staff in relevant competences using a transnational training network. It does this using the prehistory knowledge base and artefacts of its partner museums in Rome, Athens, Berlin, Bucharest, Budapest, Prague, Sofia and Vienna.

The purpose of this report is to outline the nature and character of the virtual museum and suggest ways in which training contributes towards its accomplishment. In doing so, the report the touches on areas of change management, team working, web design, marketing, cataloguing and databases, e-learning and training needs analysis.

Section one of the report considers the definition, classifications and typologies relevant to scientifically defining the virtual museum. In section two the goals and objectives of the virtual museum are discussed and analysed with a view to evaluating the functions required in a project team delivering a virtual museum project. Section three of the report details these functions identifying four key functional roles: project leadership, computing expertise, content expertise and web expertise; supported by seven areas of competence: photography, finance, e-learning, web designer, web developer and web manager and communications. In section four, the report suggests a training needs analysis approach to identifying training needs in each museum and ways in which relevant transnational e-learning can be organised. The report concludes by summarising the potential beneficial impact of the project on equal opportunities and social dialogue.

1 Definitions, classification and typologies

1.1 The Internet revolution on the sector

The development of the Internet associated technological progress in computer graphics and diffusion of information and communications technology (ICT) networks is enabling innovative exploitation of cultural goods. Although in the past some museums have been slow adapters of new technologies, many are now eagerly embracing web-enabled ICTs as a useful instrument to develop new modalities of supply of their cultural heritage, which after a first period of experimentation is becoming the main way of provision of culture throughout the world.

Internet technology diffusion allows the development of museum sites and their increasing sophistication in terms of interactivity in augmenting culture, meaning that traditional physical museums are progressively being complemented by new approaches and offers via virtual museums. Particularly important are applications enabling the access of museum-based artefacts and museum-generated knowledge for e-learning and widened access.

Computerisation has a long history in museums for inventories and cataloguing and in numerous disciplines (especially archaeology), computers are widely used in the analysis of objects. Often, however, these traditional uses of computers in museums have been restricted to off-line usage by researchers. For example, before the recent expansion of Internet access, in the United Kingdom from the eighties the use of networks by museums has been restricted to a sample of high-level users like university departments with access to the UK joint Academic Network (JANET).[1] The current challenge for museums is to widen (socially and physically) access and improve the quality of cultural heritage experienced by virtual museum visitors.[2] Within museums, Internet and digital imaging technologies are now becoming disruptive technologies supporting an exponentially expanding quality and quantity of access. In addition to the Internet, other ICT-enabled cultural products (CD-Rom and DVD for example) allow an increase of the market for museums and allowed new applications revolutionising their approach towards computer-based service offers.

This transformation creates new challenges for museums, especially for copyright and for the funding of museums (in the absence of clear business models to supplement physical ticket sales). Such challenges accompany opportunities to increase access especially for small institutions and those located outside of major visitor centres.

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1 Gordon S (1997) The virtual museum – who needs it Proceedings of the 25th anniversary conference of CAA – Archaeology in the age of Internet Birmingham April 1997. BAR International Series 1999.S.

2 Gordon (1997) ibid.

In summary, the Internet is a fertile environment for cultural goods, with the number of sites offering such products rising dramatically, using some of the modalities listed below.[3]

- Cultural institution's homepages closely aligned to a physical museum.
- Exhibitions that are available only on-line.
- Sites offering the virtual reconstruction of specific issues/subjects.
- Communities of museums.
- Inventories and repositories of artefacts.
- Downloadable software supporting the interrogation of cultural heritage.

1.2 The impact of computer graphics and virtual reality

Computer graphics enchantment and virtual reality (VR) are also important support technologies for virtual museums. VR is the array of technologies allowing users to enter into an artificial environment, based on computer software. Like many computing technologies, VR has its origins in military research – in this case the operation of aeroplane instruments via a helmet sensitive to eye movement and voice command. Currently VR enjoys increasing use in training simulation and design and the entertainment and the cultural sectors.

VR technology has three elements.

- tracking sensors for the interaction human-computer
- a reality engine for creating the virtual environment
- visualisation tools allowing to get an image sensation of the reality engine graphic computations.

1.3 Digital museum, online museum or virtual museum?

A museum is an institution that collects, studies, exhibits and conserves artefacts and exhibits for cultural and educational purposes. Originally funded by wealthy individuals or church and royal organisations, the emphasis in the activity of museums during the twentieth century began to place more emphasis upon public access and to include everyday items in addition to rare or precious objects. Open access and interest in social evolution widens the variety of museums to include open air and mobile exhibitions in addition to grand buildings. Conventionally museums specialise in art (Louvre, Prado, Uffizi, Tate, Guggenheim and Pompidou), history (Budapest National and Versailles) or science (British, Mexico City and Deutsches) – though many museums now avoid these distinctions and folk or social museums tend to thematise social trends. Many museums now seek

[3] More than 10,000 all over Europe and more than 3,000 in Italy Kim H. Veltman (2002) – European Networks of Excellence and Japanese/Unesco Skill Roads

to attract visitors with entertaining and interactive exhibitions, flexibly designed to target both scholarly and less erudite visitors. Such shifts in emphasis have important implications for the curatorial staff, tending to widen the competence base from collecting and cataloguing towards exhibiting and interactive displaying. Given the variegated nature of museums, it is not possible to definitively characterise the virtual museum, it is however possible to describe it.

By 2001, the official definition of Museum supplied by ICOM (International Council of Museums) includes *digital creative activity*.[4] Many terms are used synonymously to describe these activities. Here, we avoid the term *electronic museum* since it emphasises technological rather than its socio-technical application. *On-line museum* describes Internet connectivity, without necessarily indicating a high degree of interactivity. Whilst *digital museum* can be interpreted as giving interactive access to the knowledge stored in a museum, there are many forms of digital access that are neither remote or nomadic, thus the term is of limited applicability. Aligning with the ICOM statue,[5] we prefer the term *virtual museum* since it distinguishes museum offers from those physically available, yet

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[4] Article 2 - definitions of the ICOM Statutes, amended by the 20th General Assembly of ICOM, Barcelona, Spain, 6 July 2001.

[5] A museum is a not-for-profit making, permanent institution in the service of society and of its development, and open to the public, which acquires, conserves, researches, communicates and exhibits, for purposes of study, education and enjoyment, material evidence of people and their environment. The above definition of a museum shall be applied without any limitation arising from the nature of the governing body, the territorial character, the functional structure or the orientation of the collections of the institution concerned. In addition to institutions designated as "museums" the following qualify as museums for the purposes of this definition: natural, archaeological and ethnographic monuments and sites and historical monuments and sites of a museum nature that acquire, conserve and communicate material evidence of people and their environment; institutions holding collections of and displaying live specimens of plants and animals, such as botanical and zoological gardens, aquaria and vivaria; science centres and planetary; non-profit art exhibition galleries; nature reserves; international or national or regional or local museum organisations, ministries or departments or public agencies responsible for museums as per the definition given under this article; non-profit institutions or organisations undertaking conservation, research, education, training, documentation and other activities relating to museums and museology; cultural centres and other entities that facilitate the preservation, continuation and management of tangible or intangible heritage resources (living heritage and digital creative activity); such other institutions as the Executive Council, after seeking the advice of the Advisory Committee, considers as having some or all of the characteristics of a museum, or as supporting museums and professional museum personnel through museological research, education or training. (ICOM Statutes, amended by the 20th General Assembly of ICOM, Barcelona, Spain, 6 July 2001)

suggests a high degree of connectivity and interactivity coupled to a positive migration of the physical museum into a virtually accessible form. The term is democratic, in that under this terminology many small or specialist exhibitor become included under the umbrella term museum – taking it back to its original Greek meaning of a store of knowledge designed to promote conceptual enquiry.

This characterisation of the virtual museum closely aligns with the recent work of Forte (2003) on the cognitive impact of ICT upon cultural heritage. Forte (2000) argues that without presentation in an information context, cultural goods revert to objects of aesthetic contemplation.[6] His view is that virtual access to cultural goods can give greater control and access to information for the viewer, thus enriching his/her cognitive interaction by reducing the barriers found in physical museums. Thus, the virtual museum is cognitive space with the property of rendering intelligible, (and potentially dynamic), its contents in the network of relations reflecting or recreating their original context.

It is precisely the transacting of this intelligibility and (socially constructed) context, which Davis argues virtualisation transforms from the offering of the tradition (physical) museum.[7] Thus, not only does the virtual museum invite visitors from differing perspectives and levels of knowledge to construct different experiences of a museum; the processes of virtualising, (as Garzotto, Mainetti, Paolini, 1996) point out, is intrinsically one in which museums create flexible new contexts and frameworks with which to exhibit objects. These new contexts and frameworks include multimedia, logical and chronological linkages.[8] The characterisation of the virtual museum closely aligns with that of McKenzie (1997) who defines the virtual museum as follows.

> …. an organized collection of electronic artefacts and information resources - virtually anything which can be digitized. The collection may include paintings, drawings, photographs, diagrams, graphs, recordings, video segments, newspaper articles, transcripts of interviews, numerical databases and a host of other items which may be saved on the virtual museum's file server. It may also offer pointers to great resources around the world relevant to the museum's main focus….[9]

McKenzie (1997) goes on to differentiate two categories of virtual museum - learning and marketing – based upon type of access.

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6 Forte M, (2000) – About virtual archaeology: disorders, cognitive interactions and virtuality.

7 B. Davis (1994) "Digital Museums", in *Aperture Magazine*, Fall.

8 F. Garzotto, L. Mainetti, P. Paolini, (1996) Navigation Patterns in Museum Hypermedia, International Conference on Hypermedia for Museums, S. Diego (CA).

9 Jamie McKenzie (1997) – *Building a Virtual Museum Community.* Paper presented to the "Museums & The Web Conference", March 16-19 1997, Los Angeles California.

- *Learning museums* - Based on web sites offering a wide knowledge base that is aimed for multiple visits and in-depth studies.
- *Marketing museums* - Based on web sites developed with the main goal of increasing the number of visits to the original museum and so offer information on its activities, exhibitions and special events and usually have a virtual shop too.

Whilst conceptually attractive, these distinctions seem rooted in differentiating the quality of conceptual interaction and are less useful than Forte's (2003) inclusive approach based upon wide access, socially constructed learning environments.

1.4 Virtual museums as e-services[10]

We define e-commerce *as commercially purposive systems or processes of search, assessment and transactions, including post-transaction interactions, enabled and supported by ICTs.* In a variety of shapes and ratios, e-commerce features physical and virtual constituents and its lifeblood are the communities of customers and suppliers interconnected and interacting to constitute markets. C*onnectivity* and *interactivity* are fundamental features of e-commerce coupled to a third feature *agility* - characteristics examined in detail below. It is worth noting that e-commerce can involve interactions within and between at least three sets of parties: private business (B), public administrations (PA) and consumers/citizens (C). Figure 2 shows a classification of these types of interactions. Note that the sequencing within titles is not important, thus PA2B equally represents B2PA. Already the PA title is dated since it represents publicly funded not-for-profit service traders. Since 20% of new employment in Europe is now in the important third (or voluntary) sector, the PA category may require some re-designation.

B2B	B2C	B2PA	PA2PA	PA2C	C2C
Business to business	Business to customers	Business to public administration	Public administration to public administration	Public administration to customers/ citizens	Direct exchange between consumers
Growth area, currently 75% of value of Internet ecommerce	Mainly 'buy,' some 'barter.' Powerful for information and difficult search/ assessment products	Public tendering via ecommerce, also paying for and accessing PA services to business	Joined-up-government agenda. Also important in holistic and integrated ICT innovation planning	E-commerce, e-services and tele-democracy	Consumer initiated buys, bids and barters with other consumers. Often 25% commission.

[10] See Kinder T, 2002, *Emerging ecommerce business models: an analysis of case studies from West Lothian, Scotland*, European Journal for Innovation Management, Vol. 5, No. 3, pg. 130 – 151.

Figure 1: Spectrum of ecommerce business transactions

Commercial activities revolve around exchange, which decomposes into three elements: search, assessment and transaction (SAT). This is also valid for e-commerce. Kinder (2000) uses this approach to analyse Internet-based recruitment. *Search*, the purposive prospecting around options meeting an effective demand and involves collecting, (at a cost), by current or previous study, available options, their costs and consequences. Doing this in a virtual market-space, as opposed to a physical marketplace may prove faster and less expensive for customers. A second element of exchange is *assessment*: making a judgement on information and options and their consequences. As Veblen (1953) established, assessment is often socially patterned into bounded socio-cognitive effort. Exchange processes are concluded by a *transaction*: a mutual interchange of values resulting in a change of ownership or use and any after-care service, usually this entails a monetary transfer and may be synchronous with or before search and assessment. Each element of the exchange process contains at least one decision node for the purchaser. This approach is similar to the reach, richness and affiliation process developed by Evans and Wurster (1999). The SAT decomposition of exchange is from a user-perspective focusing upon the exchange rather than the person or organisations participating in it. A similar approach to SAT is taken in the web site assessments conducted at http://businessmedia.org.

Figure 2 summarises how the SAT elements of an e-commerce exchange differ from off-line physical exchanges. Decomposing exchange into elements can not only assists detailed analysis of business processes, this approach also highlights the significance of the Internet's connectivity and interactivity for e-commerce business models.

SEARCH	ASSESSMENT	TRANSACTION
• Wider • Deeper • More thorough • Less expensive • Less time consuming • Segmentation of markets and focus of searches	• Wider benchmarks • Less expensive • Supports cognition • Less time consuming • Degree of interactivity available during assessment	• Speedier • Less expensive • Audit trail of transaction • Use of Net community • Accuracy of digital information and payment transmissions • Irrelevance of distance

Figure 2: Showing how ecommerce exchange potentially differs from off-line exchange in search, assessment and transaction elements

Figure 3 represents a simple Internet-based e-tail e-commerce business. Like any business, its sustainability depends upon income exceeding costs. The main costs under search are site construction, upkeep and marketing; for assessment

and transaction, the main costs are the product/service, distribution, administration and support (such as call centre).

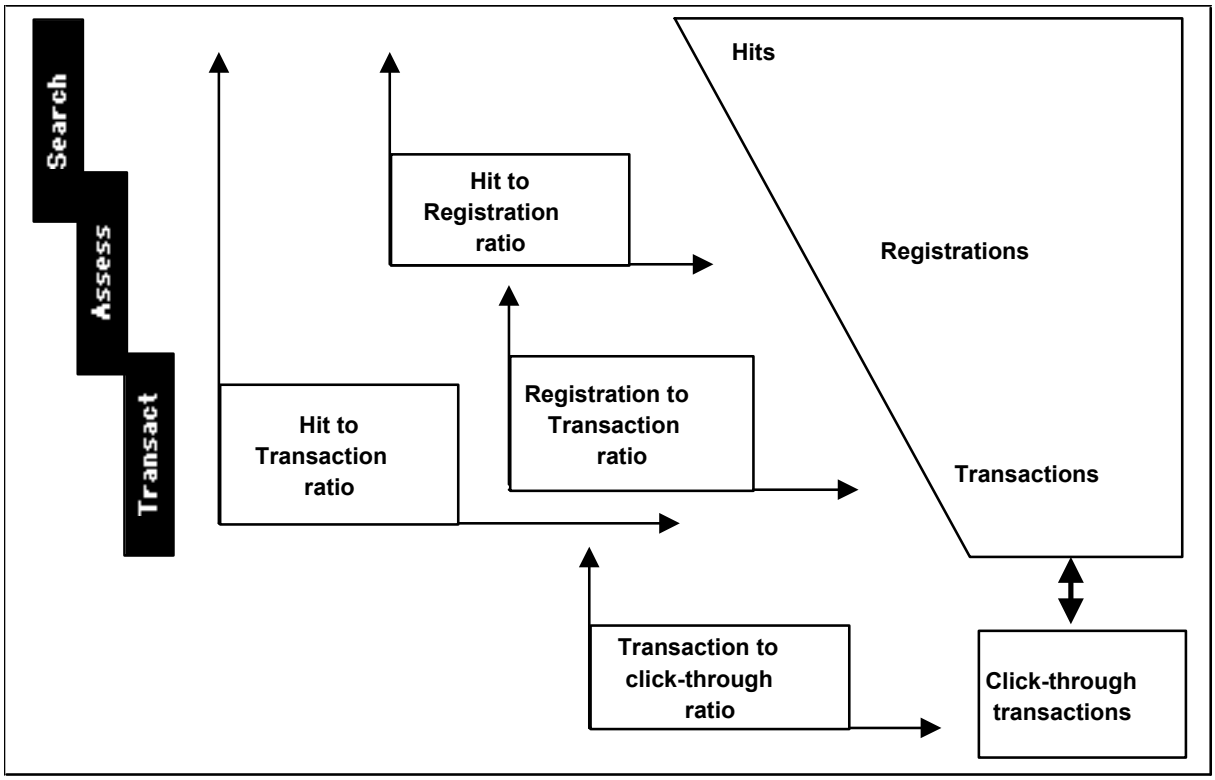

Figure 3: Showing the importance of site 'stickiness,' conversion ratios and click-throughs

Some income may be made from advertising (typically very little) and commission for click-throughs, however, the main income is from sales and after-sales services. The sticky site is well-designed, easily navigable and directs visitors towards making a purchase (it inspires confidence in security and privacy). Conversion ratios vary with product and customer base. By way of illustration, using figure 3, if one in ten hits register, and one in ten of these make a purchase, then one in a hundred hits conclude a transaction. Important dynamics in Internet-based e-commerce e-tail businesses are therefore attracting hits (search), keeping interest (assessment) and concluding sales (transaction). This is, of course, little different from many off-line businesses and supports the view of some authors that e-commerce models are little different from conventional business models (Treleaven 2000). On the other hand, others believe that all business models are now affected by e-commerce (DTI, 1999). The two views may be more complementary than contradictory, as new and established organisations must take account of business developments associated with e-commerce, such as those of intermediation/ re-intermediation and Internet communities.

As anticipated in the definition of e-commerce above, e-commerce businesses each have the three dimensions shown in figure 4. The three variables (interactivity, connectivity and agility) have each appeared many times in ecommerce theory. Interactivity here refers to virtual and physical and the relation between them (the 'click-and-brick' balance). The emphasis here is upon functional integration i.e. qualitative deployment of knowledge, rather than simply the multiplication of functions. Finally, interactivity here is purposive and not an end to itself. Complex knowledge embodied within hidden computers may (for commercial purpose) produce as rich an interaction as a learned e-forum discourse.

	Methodological dimensions of ecommerce		
	Interactivity	**Connectivity**	**Agility**
Definition	Interdependent mutually agreed actions in pursuit of a common goal - the richness and depth of shared mutual advantageous actions.	Technological and organisational openness and communications - the breadth of effective technological and social networking.	To learn from and contribute to knowledge networks and to speedily implement the organisational and technological results.
Description	Effective interactivity results in deeply integrated business processes featuring rich knowledge flows.	Connectivity relevant and appropriate to fulfilment of business strategy i.e. ability to exploit targeted value stream mediation.	Flexible, adaptable and risk taking in order to secure the advantages of early adoption of new technologies and ways of working.
Operational parameters	Efficient and speedy search, assessment and transaction - purposive deployment of relevant knowledge.	Enables and supports search, assessment and transaction with social and technological communications and interaction.	Responsiveness to market and technology changes in order for product and processes (especially SAT) to remain aligned.
Qualitative degrees	Trade-off between depth of knowledge interaction and numbers of people participating in the interactions.	More focused in B2B and PA2B than B2C or PA2C - social and technology conduits between inside business and its constituency.	Degree to which innovativeness is within the time/space which aligns and satisfies inter and intra-organisational players.

Figure 4: Methodological dimensions of ecommerce

Just-in-time processes were powerful within manufacturing plants; however, their potential was unleashed when inter-organisational relations were driven by JIT: this is the same with connectivity. De-fragmentation of functions previously separated by organisational boundaries is the simplest way to re-intermediate value streams. Note that connectivity too is purposive. Breadth of connectivity is not intrinsically of value; breadth of connectivity, which mines a profitable seam in a propitious value stream, is significant. Connectivity is both technical and social; it entails both communications linkages and knowledge networking via inter-organisational links.

Nagel and Dove (1992) have used the term *agile enterprises* to mean a firm with long-term inter-organisational relationships from which they learn in addition to learning from environmental scanning. Here the term also means having the absorptive capacity and/or knowledge generating ability to resourcefully participate in knowledge networks. Critically, the term means the capability and desire to continually innovate organisational or technological change in order to remain aligned with unfolding business opportunities. Agility is knowledge and action, *agilmente.*

Figure 5 represents these three variables constituting a framework of ecommerce modelling in a three dimensional quadrant. Degrees of high and low interactivity and connectivity correlate with degrees of agility. Unlike many models, which suggest simplistic typologies and pre-determined actions to achieve each, figure 5 shows the variants of high/low interactivity and high/low connectivity crossing over quadrant boundaries. There are two reasons for this. Firstly, such is the pace of market, organisational and technological change in ecommerce it would be wrong to suggest anything but the most dynamic model: re-configuration and change are part of the life experience of successful ecommerce companies. Secondly, there is no ‘stable equilibrium’ here. Even with a particular time-frame, poor interactivity and connectivity (for example) may be overcome where agility (for example) is exceptionally good.

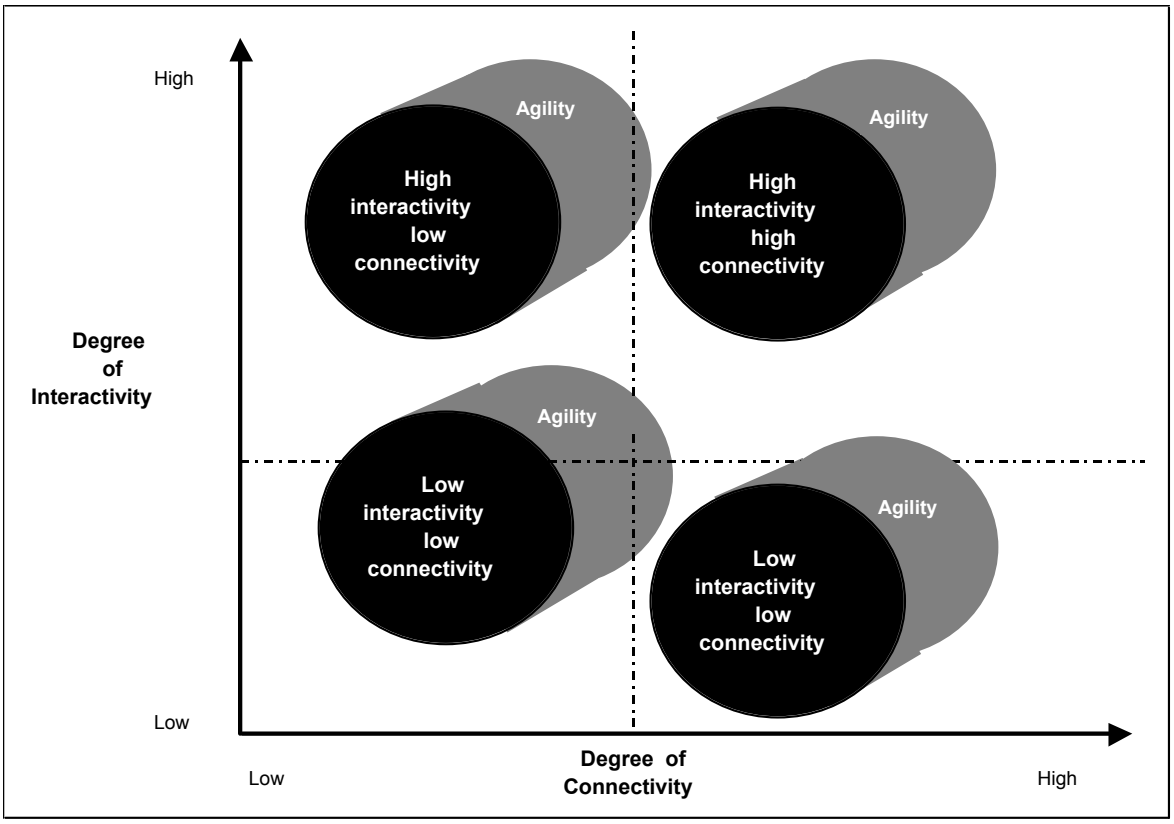

Figure 5: Connectivity, interactivity and agility in ecommerce models

From the point of view of becoming a successful business, virtual museums must therefore carefully develop an appropriate model capable of meeting customer/visitor expectations for search-assessment and transaction, with product offers that capable of delivery using state-of-the-art connectivity and interactivity. Undoubtedly, this will require service re-engineering: new products and products accessible at the front end of a museum visit in addition to their availability at the back end museum shop. The challenge of creating virtual museums is the challenge of migrating a particular physical service into an e-service.

1.5 Definition and criteria for M.U.S.EU.M. project

In one sense the connectivity, interactivity and agility (CIA) framework represents an e-services trajectory or socio-technical corridor. Museums, like many public and private services, respond initially to the Internet by creating a web site – digitally replicating opening times, location etc and perhaps non-interactive pictures of key artefacts or exhibitions. Often such initial connectivity features HTML/XTML pages and a mix of text and non-multimedia images and reflects the limited resources available for virtualisation associated with a limited appreciation of its potential. Developments in bandwidth, Java-related software and Internet security support the interactive phase of virtualisation, during which emphasis is

upon customised web offers, perhaps including virtual visits or multimedia learning opportunities. In short, higher levels of interactivity allowed museums to create web-based products specifically designed to exploit this medium and no longer merely migrated from the physical products.

Agility – the ability to learn from the market and environment and internalise this learning in the form of new products, new structures and new ways of working - is arguably the latest phase in the e-services trajectory. From the perspective of virtual museums, the challenge in this phase is to prioritise and exploit virtuality, in order to create a learning environment superior to that of the virtual museum. This learning environment will be widely accessible, feature a high level of personalisation, with the site becoming a key vehicle for storing and cumulating knowledge on behalf of the museum. The agility phase challenges previous resource distribution and demands a significant increase in the computing and communications competences in the museum. Additionally, during the agility phase, posing challenges to existing hierarchies, spans of control and ways of working. In short, in the agility phase of virtuality, ICTs and their exploitation, begin to take centre stage and becomes embedded into the whole life of the museum.

Note that progression through CIA (connectivity, interactivity and agility) phases is merely a metaphor for change and does not suggest a deterministic pattern of social and technological change. The heritage, context, opportunities and people in each museum varies, as too will the particular shape of its virtuality and the pace at which change management towards virtuality occurs. It is likely that in most cases, change will be evolutionary in nature and build upon concrete opportunities and the particular blend of competences available and taking advantage of ICT diffusion and innovations.

From the above perspective, we are defining the virtual museum in terms of connectivity, interactivity and agility. Physical museums too will increasingly use ICTs for research, cataloguing, databases, displays and administration and to a degree may converge with those of the virtual museum. The points of difference are that the virtual museum's access door is the Internet and its product is a virtual rather than physical store of artefact data (including representations) and its services (learning, viewing, researching, collaborating, and buying) are e-services delivered via the Internet and featuring extensive databases, search facilities, interaction via message boards and ecommerce.

The external relations of virtual museums (visitor interactions and inter-organisational relations) are likely to differ markedly from those of the physical museum. From the viewpoint of visitors, researchers and curators, the simplicity with which communities are established and lower investment needed to exact value from them (relative to physical networking) means that museums can support numerous niché and generic communities, becoming centres for knowledge and information exchange. Since much of the work of virtual museums

is ICT-based (digital environment, accessibility, indexes, metadata and networking capabilities) their interactions with other museums are likely to feature more sharing (resources, functions, administration and knowledge e.g. exhibitions) and joint development of virtual resources, such as e-learning applications and content. This latter point is particularly important, since only by reusing e-learning materials in many different contexts and by different users, if the heavy sunk costs of their development recouped.

2 OBJECTIVES AND GOALS OF THE VIRTUAL MUSEUMS

2.1 Mission and main constraints for physical museums

Traditionally museums gather, preserve, analyse, catalogue and display items of cultural value and interest. The ability of most museums to gather, preserve, analyse and catalogue is limited by physical space and staffing complement. Their ability to exhibit is also limited by these factors, by security and by the time/resources necessary to prepare exhibitions – a greater constraint the more interactive the exhibition. Further constraints on exhibition access include hours of opening and location: despite the growth of tourism location remains a major constraint for many potential visitors.

For some museums, the balance between space used for storage or administration and exhibition space, is a significant constraint. This is especially so where museums are located in historic city centres and/or where the costs of expansion are prohibitive. Few museums generate sufficient cash flow from charges, sales and sponsorship to dramatically expand access by creating more exhibition space. Sponsors in particular are likely to focus on one-off capital grants and not on-going costs of curatorial, security and facility management staff.

2.2 The mission of museums in the age of the Internet

Virtual museums are complementary too rather than a replacement for physical museums – a *digital alter ego.*[11] One of the first aims of a virtual presence is to attract increasing numbers of visitors to the physical museum using a virtual brochure, details of location and opening times and of special exhibitions.

Virtual museum sites are often clicked-through from general tourist information sites, travel sites etc. Visitors number to Melbourne, Australia are rapidly expanding and a new site is designed to take tourists out of the city onto an art trails through Victoria's regional galleries.[12] This is an example of what Adendorff (2001) refers to as joining the dots - positioning cultural offers as an after-market to mass tourism.[13] In summary, the Internet is a marketing channel useful in attracting visitors to physical museums.

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11 Nevertheless the function of preserving cultural heritage is still a goal of virtual museums.

12 http://amol.org.au/art_trails/

13 L. Adendorff (2001) Joining the dots – Museum trails and online cultural tourism paper presented at Ozeculture conference in Melbourne, June 2001.

2.3 Preservation goals

One of the main advantages of virtually preserving museum treasures is the re-usability of this preservation. A single example will illustrate the point. Alessandro Allori's (1544) painting, Hercules and the Muses, is exhibited in the Museum *of the Goddess Athena*, part of the Galleria degli Uffizi in Florence. As a simple photographic image, the painting appears on number web sites. Allori's painting may appear as a *knowledge nugget* in information about Italian painters, portrait painters, the Florentine school, his studentship under Angelo Bronzino, his study of Michelangelo's work, his training of his son Cristofano. In each case, the image of Allori's painting may feature in content aimed at primary school children studying Greek myths, secondary age children studying Italian art or undergraduates considering artistic families. Allori's image may be reused in numerous contexts and feature in books, slides, Internet sites, DVDs and even (perhaps sadly) migrate to wallpaper, duvet covers and kitchen towels. The point is that this one cultural artefact, once digitally preserved is re-usable an unlimited number of times – a characteristic intrinsic to the nature of digital products.

Allori's painting illustrates the importance of the virtual museum digitising artefacts in forms that render them reusable. It is thus important that content is preserved in open platforms, that with the appropriate intellectual property protection, can migrate across platforms and is likely to have complementarity with new platforms and applications.[14] The costs of reproducing digital products is insignificant relative to the sunk-costs of their original production, as all content providers who suffer from piracy know to their cost. Nevertheless, digitising Allori's painting (or any other artefact) without reproducibility (over time, context and platform) may mean that sunk-costs repeat. Choice of platform and compliance with industry standards are critical factors when virtualising cultural artefacts. Complementarity with ICT standards enables the originators of the digital version of Allori's painting to distribute it at negligible cost i.e. to use the ICT infrastructure as a (free) positive externality or free network. As Cappellini (2000) points out, technological complementarity also offers the opportunities of creating the *impossible museum*, a virtual exhibition featuring in one (virtual) space, (for example) all of the paintings of Allori's extended family or of the Florentine school.[15] Such an exhibition is likely to be multimedia and feature sixteenth century music, moving images from opera, theatre etc. In short, technological complementarity may give rise to cultural products, impossible to deliver in the physical world.

Preserving digital representations of cultural artefacts that comply with accepted standards is important is crucially important for researchers and especially trans-

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[14] B. Jackson (2001) – Collecting the virtual: acquiring digital media. Paper presented at Ozeculture conference in Melbourne, June 2001.

[15] The term 'not possible museum' has been stated by V. Cappellini (2000) La realtà virtuale per i beni culturali. Pitagora editrice. Bologna

disciplinary researchers for who database mining is a rich source of cross-references between disciplines. Mining the shared databases of the world's museums is also provides solid foundations upon which to build an ever-widening array of international research and creative communities and networks.[16]

2.4 Personalisation of the virtual museum and accessibility

E-services, unlike physical services are characterised by their configurability to customise the service towards the precise demands of the individual. In this sense, e-services mirror the mass customisation processes currently enjoying success in manufacturing. In terms of the virtual museum, instead of a curator dictating a route and points of interest, the virtual visitor is able to prescribe his/her own tour and to choose a deeper interrogation of those artefacts of most interest – in short the visitor can create their own exhibition, emphasising those multimedia modalities s/he prefers. From this viewpoint, museums shift from supply-driven to becoming demand-led, from categorising potential visitors into sets towards individual customisation and from generic marketing to one-to-one viral marketing.[17]

Of course, patterns of usage tend to occur in all e-services whether the result of habituation or predispositions to particular areas of interest or modalities of delivery. Cherri, Paternò and Piras' (2003) in the Museum of Carrara, suggests that visitors often fall into one of three sets: experts, tourists and children.[18] It may be useful to hypothesise how each of these sets may use a virtual museum.

- Experts may particular wish to use tools supporting thematic and trans-disciplinary searches, coupled to 3D applications and digital reconstruction: a high degree of configurability and informed choice.
- Tourists (who are not experts) may prefer a recommend *table d'hote* rather than *al la carte* and prefer limited configurability: more intuitive choices using readily understood narratives explaining the context of artefacts.

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16 Nwks are more purposive, reflected in govs

17 Interesting example are of systems for a segmented target are described in: F. Amigoni, V. Schiaffonati (2003) – The Minerva Multiagent System for Museum Organization. Paper presented to the workshop Intelligenza artificiale per i beni culturali, Pisa 23 september 2003; and in C. Baracchini, P. Lanari, F.Tecchia, A.Vecchi - La piattaforma multimediale Piazza dei Miracoli (2003) Paper presented to the workshop Intelligenza artificiale per i beni culturali, Pisa 23 september 2003.

18 An interesting experience regarding the Marble museum of Carrara with this target has been documented by C. Cherri, F. Paternò, G. Piras (2003) - Imparare Attraverso la Multimedialità i Processi di Escavazione del Marmo in Età Romana. Paper presented to the workshop Intelligenza artificiale per i beni culturali, Pisa 23 september 2003.

- Children (some of whom may be experts and/or tourists) may prefer edutaiment or chatboxs modalities, or exhibitions featuring games designed to simulate curiosity.[19]

Since an significant aim of virtualising museum is to increase content it is important that the technology itself is not allowed to become a barrier. This can be the case if platforms are only available on advanced (e.g. broadband or GPRS and G3 networks). Whilst ICTs can be particularly useful for people with physical and learning difficulties, if not properly planned, the digital world can become a barrier for the deaf, blind or un-dexterous person.

Mono-linguality too is a barrier to cultural appreciation and multilingual content and platform operation is an essential characteristic of cultural offers seeking to attract international visitors.

2.5 Summary: the tasks of the virtual museum

Each museum and each virtual museum, based upon its heritage and opportunities will create a unique mission, set of goals, strategies and structure accompanied by transparent success criterion and key performance indicators. The task facing each virtual museum, based on the discussions above, feature the following points.

- maximise of information flows;
- preserve information over time;
- adopt ICT and conform with user and network standards for e-services;
- increase accessibility;
- personalise the organisation of the site and of the content according patterns of a segmented demand of cultural goods;
- increase the visits to the real museum.

[19] Interesting solutions for chatbots are presented in: P. de Almeida, S. Yokoi (2003) – Interactive Character as a Virtual Tour Guide to an Online Museum Exhibition

3 FUNCTIONAL PROFILES REQUIRED BY A VIRTUAL MUSEUM

An important part of establishing the capacity and competences needed to create a virtual museum is to identify the necessary staff functions. The purpose of this section of this report is to clearly set out staff functional competences necessary to build and run a virtual museum.

To avoid any confusion, *staff functional competences* does not necessarily mean jobs and new staffing costs.

- Some of these competences will already exist in the physical museum and with adjustment of roles and re-combinations of functions, the virtual museum competences may be identified amongst existing resources. Museums like all other organisations can expect ICTs to improve staff productivity and to result in the recombination of functions that constitute a person's job.
- The particular combinations and re-combinations of functions will vary between museums as the competence of individuals varies. Additionally, one museum may in-source IT functions another may outsource, one museum may share a IT or web expert with another museum or agency, another museum may not.
- The extent of training necessary will vary between museums. A small museum may train an IT person in database management and web design, whereas a larger museum may have the budget to recruit new staff.

To be clear, the functions and competences discussed in this section cannot be taken to imply the need to increase budgets or recruit additional staff, these are however crucial competences for the team charged with building the virtual museum and fall under the following headings: project leadership, computing expertise, web expertise and content expertise. Additionally, the virtual museum needs financial, communications and training expertise.

3.1 Project leadership

Every ship needs a captain and every project needs a leader who takes responsibility for setting out a strategic vision, communicating this vision and managing the change necessary to operationalise the successful delivery of the project. Project leadership involves the management of change as opposed to the management of set resources within established systems and processes – s/he must show leadership. Relationships between an innovation project and parent organisation are always critical in order to ensure that the project meets the expectations of its promoters in outputs and value for money. Especially in a matrix organisation, the project leader is unlikely to work full time on one project.

- The project leader will take ownership of the project plan agreeing with the Project Champion (e.g. the Director) in the parent organisation a series of SMART targets (specific, measurable, achievable, realistic and time-related) that migrate the project goals and resources into a practical plan of action. The

Project Leader should be capable of conducting a critical path analysis of the project, identifying key milestones and rolling targets and setting go/n-go points.

- In doing so, the Project Leader will establish clear progress reporting arrangements to the Project Champion and progress reports and any goal re-negotiation with the Museum Board (or similar).
- The Project Leader is a budget holder and must establish systems that allocate resources to tasks over time and measure their deployment and outputs.
- In e-service innovation, one of the Project Leader's most important tasks is to weld together the different disciplines (artistic, technical, social etc) necessary for the project's success.
- The Project Leader will suggest a project evaluation plan, method and evaluators. This will include evaluation criterion and measurements.

3.2 Computing expertise

Creating a digital entity involves parallel tracking at least three multi-disciplinary processes: digital capture, formatting and applications, and interaction/access routing.[20] Multi-functional sites - likely to feature free access, subscription services and ecommerce purchases – a multimedia environment, will only successfully avoid endless debugging and/or lack of complementarity, if built within a clear system architecture. Computing expertise is an essential guide throughout this process.

- Digitalisation includes computer graphics, meta/specific databases, search engines and other off-line activities. Careful choices are necessary on time spent in 3D imaging and virtual environment manipulation and on the work of graphic designers and photographers.
- Whilst digital capture focuses upon the quality of image, formatting and applications place content in a workable application (i.e. databases). It will be especially important for a joint project between museums that a shared database and classification system is agreed at the earliest stage and that this is compatible with the overall application.
- Each learning environment is a framework aligning digitised content with choices in the flow of learning prescribed by a content specialist.

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[20] Other authors stressed the three step process as: acquisition, procession and publishing on the Web (D. Conte, L.P. Cordella, P. Foggia, A. Limongiello, C. Sansone, M. Vento (2003) - *Acquisizione e Fruizione su Internet di Opere d'arte.* Paper presented at the seminary Contesti culturali e fruizione dei beni culturali -Napoli, Certosa di San Martino 22-23 maggio 2003. Another author resumed the process into: storage, retrieval and interaction (B. Davis 1994 ibidem)

The task of computing expertise, is to continually reiterate between these three sets of tasks and the people performing them - web designer, web manager, systems designer, application provider and content specialist. Output from computing expertise is a shared product between these disciplines and without effective management costs will spiral and the project go out of control. From the viewpoint of content practitioners (e.g. archaeologists), content is king, an approach that tends towards hierarchic management rather than matrixed teamwork.[21]

In summary, a computer expert's role is to manage the parallel tracking of three distinct processes (digitisation, formatting and interaction) ensuring that a variety of disciplines work as a team to create a seamless joined-up product.

3.3 The content expert

The role of the content expert, who will be experienced and well qualified in the chosen knowledge domain is to identify artefacts, provide or select content material (including bibliographies) and oversee the flow and routing in the virtual learning environment.

- S/he will guide decisions on classification systems and database fields, suitable selection and search criteria and site mapping and routing.
- This content expert will also oversee site evaluation by peers or focus groups and guide redesign processes.
- S/he will act to guarantee the quality of the content, mindful of the cost of quality and budget/time constraints.
- Overall, the content expert will stipulate the boundaries of the knowledge domain – in effect, the size of each exhibition or learning module. This is likely to involve planning a series of small knowledge nuggets that eventually constitute a whole learning environment.
- Different modalities of e-learning are appropriate to a variety of knowledge domains and types/levels of learner.[22] Part of the content expert's contribution will be to evaluate the relevance of particular applets and iteration systems to the virtual museum, appraising in each case their relevance in a variety of learning flows (e.g. researcher, tourist, student) and their place in the attractiveness of the site.

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[21] Forte points out the relevance of the content expert when thinking to the construction of aercheological 3D environments. Aercheologists should manage the efforts architets, computer scientists, graphic artists and multimedia experts M. Forte (2000) – About virtual archaeology: disorders, cognitive interactions and virtuality

[22] Kinder T, 2002, Are Schools Learning Organisations – the innovation of computers into secondary school classrooms and their affect upon attainment, Technovation, Vol. 22, pg. 385 - 404.

- As a qualified practitioner, the content expert is well-placed to advise the Project Leader on training opportunities for project team members and how the final product can relate to existing educational courses. Additionally, the content expert will advise the Museum Board, via the Project Leader on the training needs of the museum, if it is to successfully expand its virtual presence. This task is likely to involve a Training Needs Analysis covering all museum staff.
- The virtual museum presence must be a multi-lingual and the content expert may be able to advise on knowledge networks that the project can access able to assist with translation and access content in a variety of languages.

Ideally, the content expert will then have sound e-learning pedagogic skills in addition to expertise in the chosen knowledge domain.[23] As such, s/he will be able to evaluate the relevance of the numerous pedagogic software packages available (the computing expert their compatibility with the system and platform).[24]

3.4 The Web experts: designer, developer, manager

The functions of the computing expert (especially applications) and the content expert (e-learning applets and iteration systems) must closely align with the final web site or portal product of the project. A central task of the Project Leader will be overseeing this alignment: in effect, bringing together the technical and content layers of the project. Web expertise also relates to the business model the site will use in terms of access routing for subscribers, purchasing customers and casual visitors. The project requires three areas of web expertise: design, development and management of the live site.

- A *web designer* will work with the Project Leader and Content expert in planning the site layout. S/he will design the structure of the site, indexes and metadata, in close co-operation with the Project Leader. This task also involves the style, feel and navigability of the site – in each case with target users in mind and reflecting the values of the participating museums. It is a great advantage of virtual museum that its routing need not mirror the sequencing in the physical museum - it allows thematic routing and experimentation. Finally, the web designer will advise on how the site can facilitate the generation of new web communities, based around site content.

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23 In M. Forte (2002) – Communicating the "Virtual" a pattern of cognitive interaction is outlined and is developed the idea of reticular spatial learning as typical feature of VR.

24 In A. Sbrilli Eletti (2003) – Immagini dense. Le riproduzioni digitali d'opere d'arte come interfacce di esplorazione delle opere stesse. Paper presented at the seminary Contesti culturali e contesti dei beni culturali. Napoli, 22-23 may 2003 is avalaible the presentation of some cultural product of the edutaiment kind, for promoting learning through an easy approach.

- A *web developer's* function (perhaps the same person as the designer) will work with content and digitalisation experts to implement the web design. S/he takes graphics and content fusing them into the online pages – always with an eye to usability by target visitors (e.g. language, symbolic meaning) in a clean and clear structure. An important aspect of usability will be compliance with standards for disabled users (deaf, visually impaired etc). The developer will participate in technical testing and user piloting of the site.

- The *web manager's* tasks begin as the site goes live and involves site maintenance, updating and support to Internet communities. Thus, the web manager is the guardian of the site's mission and design integrity over time and liaises with technical and content experts as the site evolves. Additionally, s/he manages site information tools such as mailing lists, website databases, search features and on-line forums. Continual evaluation of the virtual museum site (customer/visitor feedback and user logs) will be analysed by the web manager and result in continuous improvement ideas and marketing initiatives.

3.5 E-learning expert

Section 3.3 above suggests that the content expert will preferably have pedagogic expertise and ideally experience in e-learning. The e-learning functions may well feature as part of a wider combination of functions and are not necessarily a different job or person.

E-learning offers the use and reuse of multimedia, customised learning materials the preparation of which involves high sunk costs (often a factor of six times the staff time to prepare traditional materials).[25] Thus, e-learning is only likely to be justified economically where student numbers are high, core materials are often reused and/or where materials are collegiately developed. E-learning (like all e-services) opens up previously closed and localised markets to new competition from overseas or between networks of providers, especially where certification and validation is offered from prestigious organisations. E-learning assumes a high level of sunk cost and investment in ICT infrastructure and staff development, placing a premium upon collaborative development and the use of easily updated and reused *shells* to structure courses.[26] The advantages of e-learning are low

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[25] A useful selection of online papers on the advantages and benefits of e-learning includes the following: Harris P, 2003, *ROI of e-learning: Closing in*, at www.learningcurcuits.org/2003/feb2003/roi.html and www.careerjournal.com/hrcenter/astd/features/20030214-astd.html Kettleborough J, 2002, *Measuring the results of e-learning* at www.corollis.com/article_measuring.htm and Kruse K, 2002, *Measuring e-learning's benefits* at www.e-learningguru.com/articles/art5_3.htm

[26] Deeny E, 2003, *Calculating the real value of e-learning*, Industrial and Commercial Training, Vol. 35:2, pg. 70 – 72.

cost, student control of learning pace, remote and nomadic access and ease of assessment.

E-learning expertise is inseparable from content, design and computing expertise integrally relates to each. It may be that e-learning modules can become part of accredited courses and/or stand-alone as certified modules with study Diplomas issued by museums. Where accredited and assessed modules are offered, then the e-learning expert will arrange tutorial support, assessment marking and certification.

3.6 The financial manager

Many museums have a strong public service ethos and judge success in terms of visitors and the quality of exhibitions as adjudged by peers. These are important success criterion. Value-for-money and return on investment are equally important and can be significant factors in justifying investment in projects such as a virtual museum. Thus, the virtual museum project needs the support of financial expertise in order to track costs and income, in short the difference that the project makes financially to the parent museum. This is particular important since the virtual museum's on-going revenue costs are likely to as significant as the original capital costs.[27] It may also be possible for a finance manager to suggest opportunities for sponsorship, advertising revenue and product sales. Only where income and costs are clear is it possible to benchmark between museums and institute best practice exchange.

The finance manager is unlikely to be a full time or new post and more likely to be part of the duties of an existing staff member. S/he will be an invaluable source of management information to the Project Leader.

3.7 Communications expert

The communications expert is again unlikely to be a whole time job. These functions are important if the virtual museum site is to be well-positioned in web search engines, academic literature and in tourist literature. S/he can readily position the site as a click-through on other relevant sites and feature its offers in Internet networks and portals.

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[27] K. De Vorsey (2001) in MIT Communications forum, The digital museum, 8 march 2001.

3.8 A framework of the professional profiles

Figure 5 illustrates a virtual museum project team (inside the circle) and its reporting function to a Project Champion and eventually the Museum Board (or equivalent). To repeat the points made at the beginning of this section, each of these four major functions and seven support functions is not necessarily a full job, these are simply the function necessary to undertake the virtual museum project.

Each team member will understand and flexibly work towards the project gaols, in addition (perhaps) to performing other functions.

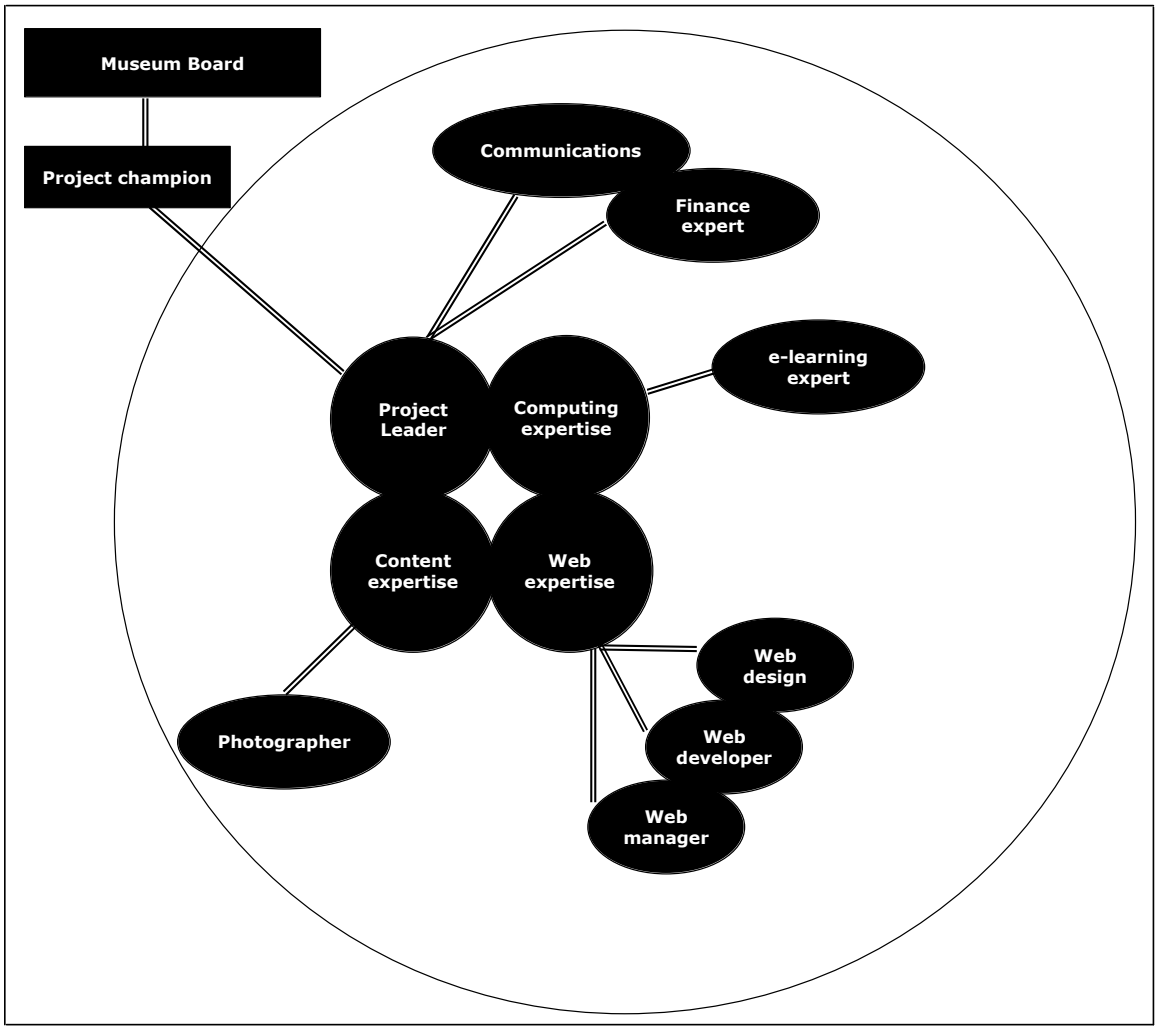

Figure 5: Virtual museum project team

Project management, particularly of multi-disciplinary teams containing professionals is a complex task in itself. It may be that the first training in this project is refresher or initial training in project management for the Project Leader.

Part of the challenge in managing a multi-disciplinary team is gaining respect for a multiplicity of competences and acceptance that ICT enables staff to multi-task and take responsibility for more functions – in short the challenge of the project leader is to set style accepting new ways of flexible working. The example of the Project Leader can be important is establishing the new style.

4 ROLE AND SKILLS OF THE FUNCTIONAL PROFILES

This section details the training needs analysis approach and suggests ways in which, using e-learning, museums might use transnational co-operation to deliver relevant training.

4.1 Training needs analyses (TNAs)

TNAs are a systematic assessment of the value-for-money of training expenditure at the level of the company and are based upon three principles: firstly, that training is an investment from which the company should receive a computable return. Secondly, training is not a *quick fix*, this return is likely to both short-term and long-term. Finally, training decisions, like those of all investments, are best taken from an informed viewpoint and within the context of a company development strategy.

Where carried out effectively, a TNA can be a valuable intervention tool, giving focus to:

- Current business activity
- Options for the future
- Skills requirement
- Plan of action

TNAs are usually kicked-off by meeting key members of strategic-level staff (owner or Chief Executive). This places the TNA in the context of a Strategic Business Review, which clarifies and makes explicit current business activity and issues, opportunities and markets, financial and HR overview. The strategic overview then informs the format and content of the TNA, allowing it to focus on relevant levels of need, such as the following.

- The business as a whole
- Specific departments (i.e. a particular manufacturing line or IT department)
- Key issues such as ecommerce, IIP, Succession Planning, Health & Safety or Quality

Once the focus of TNA activity has been agreed with the management team, TNA investigators turn to feedback from individual members of staff. Methods employed usually include one-to-one discussion, focus groups feedback and confidential questionnaires. From this exercise it is possible to identify:

- Establish an operational perspective
- Identify existing employee skills
- Establish perception of individual job roles
- Seek feedback on how employees measure their ability in relation to their perceived job roles

- Identify current skills gaps
- Inform likely future skills gaps

In addition, employees are encouraged to identify their preferred learning styles (e.g. classroom, project based, one-to one-support and mentoring, eLearning or distance learning).

Business and employee feedback is then analysed and an Action Plan drawn up which details:

- A summary of the current state of the business
- A statement of the TNA focus
- An overview of the issues and opportunities
- A skills analysis
- Identified training issues:
    - Individual training needs matrix (detailing training requirements, timescales – short, medium and long term)
    - Preferred learning styles
- If appropriate, links to training agencies (e.g. local centres, eLearning packages, Colleges etc.)
- Detailed action recommendations

It is important that the TNA Adviser, although working for a training agency, maintains a degree of impartiality, recommending appropriate training and not simply that which is most easily available.

The TNA should be considered and adopted at the highest level of the company, taking ownership of its analysis and recommendations as a guide to future actions, course selections and evaluation strategy.

Finally, success criteria will be agreed for evaluating the success of the implementation of the TNA and a cycle of monitoring and evaluation set out. Success criteria must include both qualitative and quantitative measures.

4.2 Virtual museum project training

Section 3.8 above concludes that a key part of launching a virtual museum project is a clear job and person specification of the staffing complement necessary to implement the project and section 4.1 suggests that a training needs analysis will reveal gaps in the competence of existing staff and how these might be filled. Like all innovation projects in established organisations, a key part of the innovation processes is enabling staff to carry out new functions and work in new ways.

Training for the virtual museum project should begin with the pilot implementation team (in this case on prehistoric exhibitions) with plans for the rollout of training over time, that targets staff likely to become involved.

Competence training will be specific to each museum, since in each case the skills profile of existing staff will vary. In one museum, more staff will be ICT literate (e.g. ECDL level) than another; one will have pedagogic competence in-house and another may not.

The availability of relevant training and cost is likely to vary between institutional settings. It may be that where a training module is available to one museum, that this itself can be digitised and offered across borders in a distance learning, e-learning format. In this way, the MUSEUM Project itself may become a brokerage for training. One added-value of the project, from a training perspective, can be the establishing informal meetings of staff and cross-border interactions (newsgroups and email discussions) in particular areas of training. In these ways, the project itself will catalyse co-operation around training and exploit the use of digital communities.[28] A mission of museums is to store and disseminate knowledge a facet of their work that should extend to their own staff. E-learning for museum staff can become an important building block for promoting the virtual museum vision and its own e-learning goal and encourage closer interaction between the various disciplines working in museums.

Where museums do not have a Training Manager or Knowledge Manager, the task of instigating a TNA and planning training for the virtual museum is likely to help in the adoption of these advanced management structures.

[28] In Jonathan Bowen, Mike Houghton, Roxane Bernier (2003) - Online Museum Discussion Forums: What do we have? What do we need? is available a relevant analysis of the resources for cultural communities on the WWW.

4 JOB AND PERSON SPECIFICATIONS FOR VIRTUAL MUSEUM

Section three above began by explaining that the staffing competences necessary to create a virtual museum may already exist in the physical museum and that combinations and re-combinations of functions coupled with training are likely to mitigate against the need to recruit new staff into each of the function roles section three outlines. The purpose of this section is to unpack these functional roles and suggest specific competences and attributes that the function provider will require. The current report links closely with D 4 (Characteristics, extent, profile of European museums' websites and case studies on best practices) and later deliverables by informing MUSEUM's training programmes and business planning. The section suggests a set of person and job specifications for each functional role in the virtual museum project team.

Each museum begins building its virtual presence with a particular heritage in terms of staff competence and capacity. One museum may have a great deal of (for example) archaeological content expertise but little in Web management and finance. In this example, the virtual museum project team may redeploy existing expertise and bring in new people to fill its competence gaps. Thus, its is not possible to prescribe a particular staffing structure, since each museum's team will be differently configured, whilst each should contain the competences set out in section three above.

Figure 6 outlines the person and job specification of the Project Champion. It is likely that this person will be a Museum Board member, capable of supporting an innovation process with ramifications for the overall museum strategy, structure and product line.

Job outline: Project champion	
Person specification	• Authority of being part of Museum management team • Commitment to virtual museum project • Evangelist for project • Understanding of project goals • Guardian of budget and resources within Museum management team.
Job specification	• To support and sponsor the virtual museum project within the Museum Board • To liaise between the Board and the Project Leader - especially in areas relating to museum strategy. • To support the Project Team's planning, implementation and evaluation.

Figure 6: Project champion outline

Figure 7 outlines the person and job specification of the Project Manager. Note that some museums operate hierarchically, privileging knowledge expertise above other competences. It may be that the Project Manager breaks this mould and appoints someone lower in the hierarchy who meets the appropriate person and job specification or alternatively an outsider.

Job outline: Virtual Museum Project Manager	
Person specification	• Leadership and general management ability over a complex innovation process required to deliver a specific quality of outputs, on time and within budget. • Problem solving ability. • A deep understanding of the museums culture, its approach to database creation and use and marketing.
Job specification	• To manage and motivate a team that includes a variety of professionals from mixed governances (i.e. in-house and external) and disciplines. • To plan the project and set SMART targets for its completion including key milestones, go/no-go points and rolling targets. • To communicate effectively with the team, co-workers, external funders, partner museums, network providers and the Project Champion. • To hold and control the project budget • To create a project evaluation plan, method and evaluators including evaluation criterion and measurements.

Figure 7: Project Manager outline

Figure 8 outlines the Computing Expert role and particular person and job specification. Note the assumption that this person will manage this function beyond launch date.

Job outline: Computer expert	
Person specification	• The ability to work in a trans-disciplinary team. • The ability to deliver a specified quality of output, on time and within budget. • Ability to manage the parallel tracking of three distinct processes (digitisation, formatting and interaction) ensuring that a variety of disciplines work as a team to create a seamless joined-up product. • Knowledge of relevant information and communications technologies (including web technologies, applications and devices), necessary to deliver the virtual museum. • Ability to integrate video, text, audio, and graphics into effective experiences. • Knowledge of SGML, HTML, XML and http; of virtual reality technologies and QTVR, JAVA and VRML. • Ability to act as the guardian of the site's mission and design integrity over time, engage in continuous evaluation and improvement and liaise with technical and content experts as the site evolves.
Job specification	• To manage within a team computing expertise that creates digitisation of content, shared-use databases supporting a learning environment. • To manage the following functions: web designer, web manager, systems designer, application provider and liaise effectively with the content specialist. • To ensure that the virtual museum project complies with prevailing industry and EU standards in data storage, retrieval, transmission and display. • To manage the computing related development and launch of the virtual museum, including piloting and its first proving period including maintenance, updating and support to Internet communities.

Figure 8: Computer expert outline

Figure 9 lists the main person and job specifications for the Web designer.

Job outline: Web designer	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Ability to work with the Project Leader and Content expert in planning the site layout. • Suitable qualifications and experience in advanced web site design. • Professional training in photography, film and digital presentations including image capture (high and low resolution digital capture) and digital presentations (such as HTML).
Job specification	• To design the structure of the site, indexes and metadata, in close co-operation with the Project Leader. • Participate in interactive design processes and evaluations featuring site style, feel and navigability. • Advise on how the site can facilitate the generation of new web communities, based around site content.

Figure 9: Web designer outline

Figure 10 lists the main person and job specifications for the Web developer.

Job outline: Web developer	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Suitable qualifications and experience in advanced web development.
Job specification	• To work with content and web design experts to implement the web design. • To create a usable, navigable and attractive website featuring prescribed content and given design. • Address security issues, passwords, firewalls, payment systems and in general against hackers.

Figure 10: Web developer outline

Figure 11 lists the main person and job specifications for the Content Expert.

Job outline: Content expert	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Ability to identify artefacts, provide or select content material (including bibliographies) and oversee the flow and routing in the virtual learning environment. • Qualified to PhD level, with a peer group reputation in chosen knowledge domain. • Sufficient computing skills to understand the issues/options raised within the project. • Skilled in cataloguing, records management, documentation, data management and data analysis. • Knowledge of exhibition design, graphics, principles of visual presentations and the use of multimedia.
Job specification	• Lead the content gathering, retrieval and presentation in the project. • Seek and represent knowledge appropriate in an e-learning environment. • access relevant resources such as literature and information sources (including bibliographies, directories and indexes. • Help manage the museum's collection and select items for digitisation. • Support the preparation of design, graphics and visual presentations using multimedia.

Figure 11: Content expert outline

Figure 12 lists the main person and job specifications for the e-learning expert (likely to be combined with other tasks).

Job outline: E-learning expert	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Ability to create usable e-learning materials in a cost-effective manner and use e-learning technologies. • Ability to work with external organisations on module accreditation, validation and certification and student support. • A professional with experience on training in computer related issues and internet and associated pedagogic techniques. • Ability to elaborate e-learning programmes based on thematic units; create e-tests to assess learning; support student learning; oversee groups of users; load files (articles, publications, manuals); and create live events.
Job specification	• To work with and support the Content Manager and Site Designer in creating a digital learning environment using the artefacts and materials generated by the project. • To prepare and help implement and evaluate module accreditation, validation and certification and student support.

Figure 12: Content expert outline

Figure 13 lists the main person and job specifications for the Finance Manager (likely to be combined with other tasks).

Job outline: Finance manager	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Professionally qualified and able to keep management accounts in a not-for-profit organisation. • Experience of working with sponsors and negotiating sponsorship. • Ability to select and oversee the integrity of the virtual museum payments systems. • Ability to work with the Project Leader on financial planning, monitoring and reporting.
Job	• Financial planning, monitoring and reporting for the

specification	project, including management accounts. • Negotiate and manage sponsorship arrangements. • Specify and oversee virtual museum payments systems.

Figure 13: Finance Manager outline

Figure 14 lists the main person and job specifications for the Communications Manager (likely to be combined with other tasks).

Job outline: Communications manager	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Experience of communication for cultural and or e-service organisations. • Skilled oriented in Internet use.
Job specification	• Plan and implement PR for the project. • Plan and implement Marketing campaign for virtual museum. • Work closely with relevant tourist, cultural and sponsorship organisations. • Generate and manage visit to the virtual and physical museum.

Figure 14: Communications Manager outline

Figure 15 lists the main person and job specifications for the Training expert (likely to be out-sourced).

Job outline: Training expert	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Experience of training relevant to virtual museum project and rollout.
Job specification	• Plan, organise and implement training relevant to virtual museum project and rollout. • Work with associate museums to deliver shared training and curriculum development.

Figure 15: Training expert outline

Figure 16 lists the main person and job specifications for the translation expert (likely to be out-sourced).

Job outline: Translation	
Person specification	• The ability to work in a trans-disciplinary team delivering a specified quality of output, on time and within budget. • Translation skills in relevant target foreign languages with

	experience of working in cultural spheres and/or e-services.
Job specification	• To translate content and materials relevant to the project. • To assist the project in its international work.

Figure 16: Translation expert outline

5 IMPACT ON EQUAL OPPORTUNITIES

The initial piloting of the virtual museum and plans for its subsequent rollout are likely to impact positively on equal opportunities policies and actions in museums.

- Small institutions can gain advantage from sharing training resource with larger institutions. This is particularly so where small institutions are located outside of major tourist centres and/or are under-funded. The virtual presence allows service providers to *punch above their weight*, in the sense of showcasing their treasures with the same professionalism and settings available to larger and better funded institutions. Technology can be a great leveller and offers the smaller and perhaps less visited museum the opportunity of appearing interesting and worthy of visiting.
- Like all innovations, the virtual museum is an opportunity to act positively against gendered structures and staff profiles. In particular, virtual working can be family-friendly if linked to opportunities for remote and flexible working. A recent survey of virtual museums, shows that almost 50% (22 out of 50) participants in projects by five museums were women and in three of the five case the project team was headed by a woman.[29]
- By its nature, working with ICTs offers the opportunity to overcome physical disability and often releases the potential of disabled employees.[30]
- Network participation is costly and the returns on investment may not be immediately obvious. Participation in Internet communities of researchers and specialists, by virtual museums enables museums to derive the benefits of knowledge flows from advanced communities at a lower cost than participation in physical networks.

In summary, as a set of tools ICTs can reinforce unequal opportunities and act as another set of barriers to disadvantage sections of society. However, used positively ICT tools can help to reduce barriers and strengthen equal opportunities. This perspective can be introduced as a thematic to each virtual museum project and evaluated as a key goal of each project.

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29 The sample has been selected with a random process and the number and the profiles of women arise from the analysis of the information included into the site. The sites of the sample are found at the following: Vivre au bord du Danube il y a 6500 ans http://www.culture.gouv.fr/culture/arcnat/harsova/fr/index.html
A More Perfect Union: Japanese Americans and the U.S Constitution. http://americanhistory.si.edu/perfectunion/
Van Gogh Museum http://www.vangoghmuseum.nl
Czech National Museum http://www.nm.cz/english/
Mysteries of Catalhoyuk http://www.smm.org/catal/introduction/

30 Even if the accessibility for disabled people is not yet common in cultural sites. It is worth of mention the site Mysteries of Catalhoyuk because it meets the requisites of accessibility of US Government's Section 508 accessibility guidelines, see http://www.smm.org/catal/introduction/

6 EFFECTS ON SOCIAL DIALOGUE IN TRAINING STRATEGIES

Qualified professionals occupy positions of privilege in the management of many organisations delivering professional services. This can be to the detriment of engagement with professionals from other governances. As services switch to e-services models, tradition demarcations between sets of competences (in this case such as archaeologists, accountants, pedagogues, support staff or technicians) becomes blurred as the service package is taken closer to the customer/visitor and integrated to suit the customer/visitor.

Such changes are an opportunity to promote social dialogue between groups from different governances, led by the expectations of the customer. Some museums have a tradition of hierarchic management by qualified professionals to the exclusion of other groups of staff or their trade unions. An innovative project, such as the virtual museum is an opportunity to shift towards a culture of team working that is welcoming to the contribution from all groups of staff. It is especially important when a project involves decisions on training and outsourcing that staff can move forward with a shared vision.