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Cultural heritage information practices and iSchools education for achieving sustainable development

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Abstract

Since 2015, UNESCO began the process of inculcating culture as part of UN's post-2015 Sustainable (former Millennium) Development Goals, which member countries agreed to achieve by 2030. By conducting a thematic analysis of the 25 UN commissioned reports and policy documents, this research identifies 14 broad cultural heritage information themes that need to be practised in order to achieve cultural sustainability, of which information platforms, information sharing, information broadcast, information quality, information usage training, information access, information collection and contribution appear to be the significant themes. An investigation of education on cultural heritage informatics and digital humanities at iSchools (www.ischools.org) using a gap analysis framework demonstrates the core information science skills required for cultural heritage education. The research demonstrates that: (1) a thematic analysis of cultural heritage policy documents can be used to explore the key themes for cultural informatics education and research that can lead to sustainable development; and (2) cultural heritage information education should cover a series of skills that can be categorised in five key areas, viz. information, technology, leadership, application, and people and user skills.

Introduction

Background

Sustainable development was formulated into UN's agenda in 1987 and ever since had informed research, policy, standards and educational programmes in multiple disciplines (Brundtland, 1987; LeBlanc, 2015). Although the environmental dimension has been discussed most frequently, economic and social dimensions together form the three pillars of sustainability (Gibson, 2006). Preservation of culture was seen as part of the social dimension until the UNESCO's World Commission on Culture and Development report (Our Creative Diversity) discussed the significant connection between sustainable development and culture (WCCD, 1995; Soini & Birkeland, 2015). Thereon, especially after UNESCO's "Decade of Culture 1988-1997" deliberations began to emerge in the forms of policy, practices and promotions within the UN and farther (Graber, 2006; UNESCO, 2001; 2005). Consequently, at different governmental layers, initiatives were proposed to sustain culture, and one of the initiatives was the Agenda 21 for Culture, whose prime objective was to integrate culture as the "fourth pillar" of sustainable development (Agenda 21 for Culture, 2015).

Role of culture and cultural heritage information in sustainable development

The role of culture in sustainable development has been recognised by academics in different areas including local government's planning strategies (Sacco et al., 2009), education (Mayor, 1999; Frietas, 2006), ecology (Nurse, 2006), industrial production (Cucek et al., 2012), tourism (Richards & Hall, 2003), creative industries (Bennett et al., 2014), agriculture (Hooper, 2013; Subhasinghe et al., 2009), political science (Focault, 2013), banking (Jeuken, 2010), food (Innocenti, 2018) and organizational management (Cartwright & Cooper, 1993). Cultural heritage is defined as *"the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations."* (UNESCO, 2018). UNESCO further affirms that cultural heritage is a key driver and enabler towards meeting the sustainable development goals (UNESCO, 2012). UNESCO further differentiates tangible and intangible heritage. Tangible heritage are mainly physical entities representing a culture such as monuments and buildings, paintings and sculptures etc. Intangible heritage are non-physical entities such as traditions, beliefs, language and knowledge etc.

Proactive communication of various cultural elements is highly essential in order to sustain culture, and thereby contribute towards sustainable development goals and creating knowledge. *"The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. These 17 Goals build on the successes of the Millennium Development Goals, while including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities. The goals are interconnected – often the key to success on one will involve tackling issues more commonly associated with another"* (UNDP, 2019).

Digital resources like the Europeana Collections project have played a significant role in digitally preserving and communicating cultural heritage of Europe (Chowdhury, 2015; European Commission, 2016). Like Europeana, Smithsonian's digital collections and the Cabinet project attempt to communicate information relating to cultural heritage (Smithsonian Libraries, 2018; Cabinet, 2018). Europeana progressed from its initial strategy of focussing on aggregating, facilitating, distributing and engaging cultural heritage information between 2011 and 2015 to providing easy access to high quality content, continued engagement and partner scalability (Europeana, 2010; 2014). Although not explicit, cultural heritage is intrinsically built into several SDGs (Hosagrahar, 2018). Cultural heritage management's importance is being emphasised by several organisations, especially the EU, which declared 2018 its 'Year of Culture' (Pasikowska-Schnass, 2018). Cultural heritage in general is found to raise development of urban and rural areas; encourages cultural tourism, creativity and innovation; creates jobs and appreciation of property value; improves quality of life, building social capital and cohesion; encourages education and learning and combats climate change to name a few (Pasikowska-Schnass, 2018; European Commission, 2015; 2017).

Cultural heritage, both tangible and intangible, connects us to the past and provides invaluable insights into our identities and evolution. It can play an important role in economic growth, poverty reduction and sustainable development (Chowdhury & Koya, 2017, World Bank, 2017; Ruthven & Chowdhury, 2015). The importance of heritage tourism for the economy has been well recognised by the World Tourism Organization and UNESCO, and it is believed that appropriate knowledge of cultural heritage can promote ethnic and heritage tourism and thereby contribute to the economic development of African countries (Teye et al., 2011). Traditional medical knowledge, which is generally considered the collective heritage of a particular indigenous people or local community, has social, cultural and scientific value and

is important for many indigenous peoples and local communities in Africa and Asia (World Intellectual Property Organisation, 2015).

Cultural heritage information can significantly boost our understanding of social structure and gender issues (Gravari-Barbas & Jacquot, 2014). Cultural heritage, and agriculture and farming are an integral part of some societies, according to the Food and Agriculture Organisation (2018). Cultural heritage promotes environmental sustainability through the intrinsic relationships between cultural diversity and biodiversity, by influencing consumption pattern through the contribution of traditional knowledge (UNESCO, 2013). Additionally, appropriate management of, and access to, cultural heritage from the traditional and indigenous knowledge pool significantly improves health and wellbeing of people in areas where modern medical facilities are hard to penetrate (UNESCO, 2018; Anyaoku et al., 2015). Cultural heritage information with appropriate tools and technologies can significantly boost creative industries, education and learning in almost every discipline, and through a multi-stakeholder approach (Europeana, 2014; Heritage Education Centre, 2018). This immensely improves classroom learnings of different aspects of life, science, art and culture. Based on the literature and reports, it can be stated that cultural heritage information has impact on different areas of life and society (see Figure 1).



Figure 1. Impacts of cultural heritage information in different fields

It is essential that cultural heritage information is usable in every sense for it to be sustainable (Jemielniak & Wilamowski, 2017; Dobрева & Chowdhury, 2010). Broadly speaking, information practices consist of mechanisms and methods of collecting information, storage and access of information, seeking and usage of information, curation of information, sharing of information and disposal of information (Cox, 2012; McKenzie, 2003; Davenport, 2009; Chowdhury & Koya, 2017). However, information practices around cultural heritage towards achieving cultural sustainability remains unclear. Losing cultural heritage information essentially means losing knowledge, leading to several repercussions (Soini & Birkeland, 2014). UNESCO is currently tackling loss of cultural heritage information through its *Building Knowledge Societies* theme and recognises information and communication technologies (ICTs) as one of the primary keys to deal with the issue (UNESCO, 2018). Although not specific to cultural heritage information, the solutions it suggests are 'Open access to scientific

information', 'Open educational resources', 'Free and open source software', 'Open training platform' and 'Open distance learning' (UNESCO, 2018). During the World Summit on Information Societies (WSIS), along with the Internet Governance Forum, UNESCO recognised the need to continuously identify information practices which promote SDGs (WSIS, 2017).

The objective of this article is to mobilise research in the area of cultural heritage information practices aimed towards achieving cultural sustainability and study the training opportunities available through courses in Information Schools worldwide. Therefore this article attempts to address the following research questions (RQ):

RQ1. How to identify the various concepts of cultural heritage information management practices that are embedded in the official UN policy documents and commissioned studies?

RQ2. In what contexts should the cultural heritage information management practices be applied to achieve the UN's SDGs?

RQ3. What training in cultural informatics is available at iSchools in general?

RQ4. How to identify a core set of information skills that should form part of a cultural informatics course that can lead to sustainable development in different sectors?

Cultural informatics could perhaps be described as an applied academic area of information science to study cultural heritage and its wider socio-economic applications. Although it has a specific scope, often cultural information, falls under the digital humanities umbrella (Stanco et al., 2011; Sula, 2013; Robinson et al., 2015). Additionally, according to Robinson et al (2015) the common interests between the fields lie in digitisation, preservation, repositories, metadata and visualisation etc, hence the fields reinforce each other. It is necessary to explore the pedagogy available within this area as it is suggested that pedagogy in digital humanities and cultural informatics has not grown as much it has in research (Klein & Gold, 2016; Bail, 2014; Jones, 2013; Poole, 2017; Clement & Carter, 2017). However, as mentioned below, this is not the focus of this study.

Originality and significance

The study contributes to the field of cultural informatics by recognising the cultural information practices necessary for achieving cultural sustainability, a key pillar in UN's vision of sustainable development. As the research mainly documents the UN studies and global

governments' assertions on cultural sustainability, it offers a global policy perspective of cultural information practices needing compliance for achieving cultural sustainability. Our study aims to draw attention of the Information research community towards the importance of cultural sustainability and initiate more discussions and debate leading to further research around teaching and research of cultural heritage information management and use for achieving SDGs in different areas. Additionally, the study's findings can potentially influence cultural informatics curriculum at higher education institutions through indicating the necessary information practices, their relevance to the current global stage and the nature of courses being offered etc.

Methodology

A two part methodology was built for this research. The first part addresses the first two research questions, which are to identify the cultural heritage information practices and the contexts where they occur in relation to SDGs. Using the cultural heritage information practices identified in the first part, the second part explores the training available in cultural informatics at iSchools (www.ischools.otg). This research specifically focusses on the training of cultural information practices in iSchools, as they are considered to be the most prominent group of institutions engaged in teaching and research in information; however, the resulting findings can be applicable to all higher education institutions dealing with Information Science, irrespective of the nomenclature of a specific course of study.

Part one

Agenda 21 is an action plan developed by the UN towards meeting SDGs since 1992 and further progression led to the creation of Agenda 21 for Culture in 2002, whose primary purpose was to unite cities and local governments to preserve culture from ground level and upwards (Agenda 21 for Culture, 2015). Thereon, it has produced and commissioned reports ratified under UN-HABITAT (United Nations Human Settlements Programme) and UNESCO (Smardon, 2008; UN-HABITAT, 2016). Twenty-five commissioned reports and policy documents of Agenda 21, listed in Appendix 1, were analysed using thematic analysis with the help of Nvivo (King, 2004). Thematic analysis is a structured process applied to discover, interpret, analyse and communicate various clusters of data or themes grounded in the text (Braun & Clarke, 2006; Denzin & Lincoln, 2011). Braun & Clarke's (2006) process of thematic analysis, as in Figure 2 was applied at this stage.

The analysis involved both inductive and deductive components with data separation to identify patterns. During the familiarising stage, all the documents listed in Appendix 1 were read to familiarise with the content. Initial ideas and notes based on concepts of information promoting cultural sustainability were generated. The text query function in Nvivo assisted in finding the concepts within the UN documents using the queries "information" and "data" mainly. Initial codes emerged from the concepts and various sections in the UN documents influencing the achievement of cultural sustainability. Iterative code checking independent of the first-coder was applied to affirm the maturing codes and to ensure rigour. Initial themes emerged from the collated codes and UN documents through a reflection on the information aspects and contexts of the codes which contributed towards achieving cultural sustainability. The initial themes were further reviewed with another round of text query and identifying further concepts within the data. Once the emergence of themes saturated, the acquired themes were refined to represent a specific definition and the context of where the themes occurred within the data was recorded. The themes were finally recorded onto an MS-Excel sheet to measure their weightage of occurrence within the dataset and draw relationships with regards to the context of occurrence.

Phase	Description of the process
1. Familiarising with data	Transcribing, reading and re-reading the data, noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes	Gathering data and collating codes into potential themes.
4. Reviewing themes	Checking the themes in relation to the coded extracts and the entire data set, generating a thematic 'map' of the analysis.
5. Defining and naming Themes	Ongoing analysis to refine each theme and generate clear definitions and names for each theme.
6. Producing the report	Selection of vivid, compelling text extracts relating to the analysis to the research question and literature, producing a scholarly report.

Figure 2. Braun & Clarke's (2006) process of thematic analysis

Part two

The second part of the study involved a review of teaching at iSchools around the world, considering the themes found in the first part of this study as a standard. The iSchools envision *"iSchool graduates will fill the personnel and leadership needs of organizations of all types and sizes; and our areas of research and inquiry will attract strong support and have profound impacts on society and on the formulation of policy from local to international levels."* (iSchools, 2018). Therefore the iSchools are ideally positioned to deliver and adapt their

curriculum which supports cultural heritage information practices in order to attain cultural sustainability. A gap analysis was conducted to review and better understand the current state of education and training available at the iSchools in cultural informatics. Specifically, an adapted framework of Clarke & Estes (2008) was applied (see Figure 3).

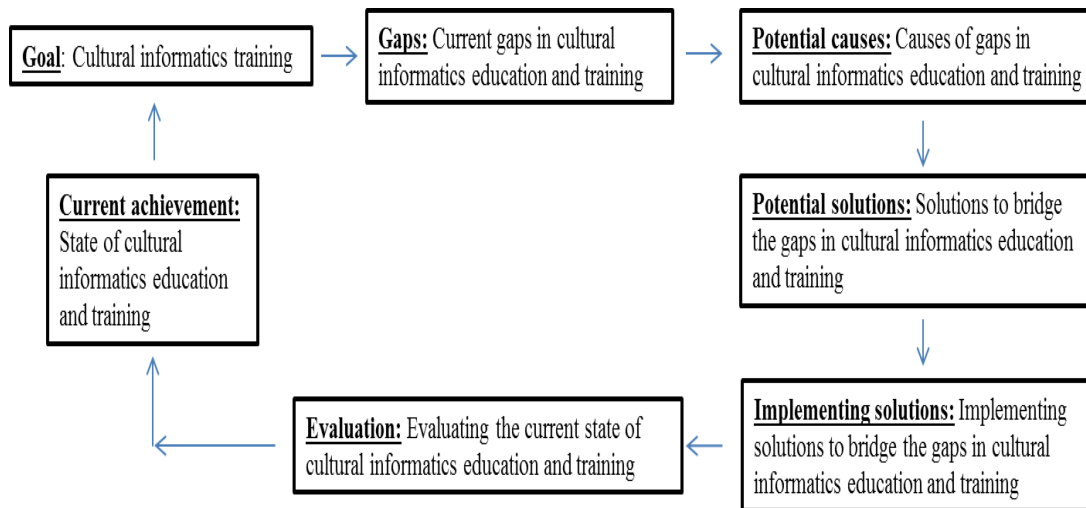


Figure 3. Gap analysis framework to evaluate the state of cultural informatics education and training. Adapted from Clarke & Estes (2008).

The goals were informed by the various concepts of cultural heritage information management practices found from the first part of this study. Subsequently, the gaps in training were found by taking a random sample of ten iSchools from each region (North America, Europe and Asia-Pacific) and making a record in MS Excel of their degree programs, modules/courses in the degree programmes at various academic levels (undergraduate, postgraduate and PhD) and interpreted module's focus i.e. Technology, culture, statistics, art and biology. Using the filters application in MS Excel, percentages of module/course focus were calculated in each region. Figure 4 indicates the data collection and interpretation process. It has to be clarified that the gap analysis was applied merely to observe the inclusion of cultural heritage information management practices within the iSchool's curriculum, but not to create the curriculum itself. This study contributes to the first two stages of the gap analysis framework (Goal and Gaps). For the remaining stages, there is current literature available on the causes of gaps in cultural informatics and digital humanities education, potential solutions, evaluation and current achievement. This literature is discussed alongside the findings.

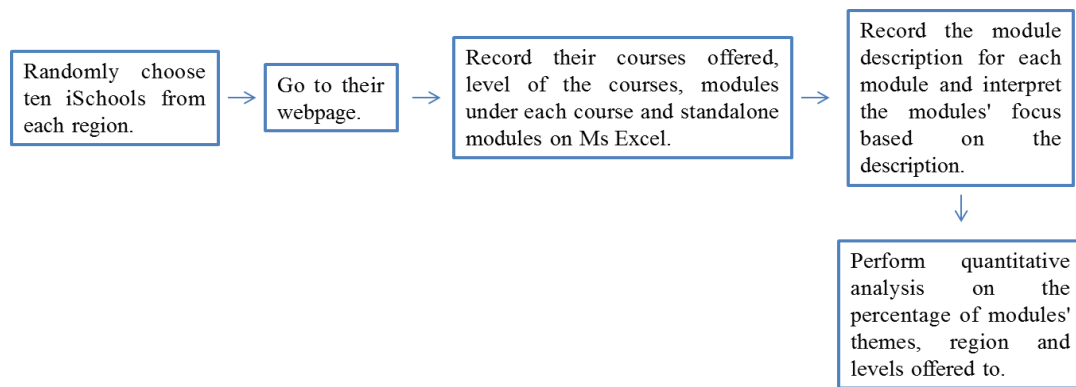


Figure 4. Process for determining courses/ modules and their focus in iSchools

Findings

Part one - Themes

Fourteen themes related to cultural heritage information practices were found, in the official policy documents and commissioned reports, which are deemed necessary towards achieving cultural sustainability (Listed in Table 1). Out of the fourteen themes, information platforms, information sharing, information broadcast, information quality, information usage training, information access, information collection and contribution appear to be the significant themes, in terms of sum of acknowledgements (indicated by weightages in figure 5), that need focus to achieve cultural sustainability. The remaining seven themes, although do not appear to be significant in terms of their acknowledgement, give an idea about the necessity of appropriate management and official accountability of cultural heritage information made available in the public sphere.

Information Theme	Definition	Context of the theme	Sample text depicting the theme
1. Cross-sectional information	Information about cultural heritage which could inform in devising regulations, medical practices, instructions and legal frameworks etc.	Within the policy documents cultural heritage information is frequently requisitioned to be considered when designing socio-economic, physical and biological, medical and health, legal and tourism regulations and frameworks.	"...physical, biological and socio-economic data. Compatible spatial and temporal scales, cross-country and time-series information, as well as global behavioural indicators should be developed, learning from local communities' perceptions and attitudes." "....disseminate information on effective legal and regulatory innovations in the field of environment and development, including appropriate instruments and compliance incentives, with a view to encouraging their wider use and adoption at the national, state, provincial and local level."
2. Information access	Provide easy access to information about cultural heritage to information seekers.	Provision of easy access to cultural heritage information is deemed useful in informing about culture change, infrastructure development, and educational activities, integration of immigrants and travellers, and environmental awareness.	"The appropriation of information and its transformation into knowledge by the citizens is a cultural act. Therefore access without discrimination to expressive, technological and communication resources and the constitution of horizontal networks strengthens and nourishes the collective heritage of a knowledge-based society." "....which systematically compiled the cultural interests and habits of people with an immigrant history by means of more than 1,000 interviews. Its results have provided important information for improving immigrants' access to cultural services and this is also relevant to other big cities with large immigrant populations."
3. Information accountability	Creation of bodies/ authorities who can take accountability of the information on cultural heritage.	Accountability must be taken over cultural heritage information provided at different levels of government to ensure any socio-economic, medical and environmental regulations etc., are in compliance with the local cultures.	"Cultural institutions that receive public support participate in debates on information and knowledge and provide consistent support for valuing culture as a common good.." "The fundamental purpose of governance is to work towards a healthy, safe, tolerant and creative society (rather than merely a financially prosperous one). This means that local governments must promote a model of development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs', as well as ensuring the enjoyment of culture and its components by all, and protecting and enhancing the rights of citizens to freedom of expression and access to information and resources."
4. Information broadcast	Proactively broadcast information about cultural heritage.	Broadcasting cultural heritage information proactively appears to inform infrastructural and technological development and management, responsible management of natural resources, attitudes towards indigenous affairs and environmental management.	"Disseminate information, whenever possible, on the utilization of natural resources and living conditions, climate, water and soil factors, and on land use, distribution of vegetation cover and animal species, utilization of wild plants, production systems and yields, costs and prices, and social and cultural considerations that affect agricultural and adjacent land use..." "The creations of every era are based on the knowledge and contributions of those that preceded them. Increased and widespread accessibility to data, quality information, and citizen participation in the creation, analysis, production, and distribution of information allows for more transparent resource allocation and better equips citizens to feel a sense of ownership of development"
5. Information collection & contribution	Create processes to collect cultural heritage information from ground level and additionally create networks for contributors.	Proactive and real-time collection and contribution of cultural heritage information appears to sustain rural and indigenous communities, helps disaster avoidance and management, regional and international accords, and various developmental undertakings.	"....collect and record information on indigenous conservation and rehabilitation practices and farming systems as a basis for research..." "Contracting parties to international agreements, in consultation with the appropriate secretariats of relevant international conventions as appropriate, should improve practices and procedures for collecting information on legal and regulatory measures taken. Contracting parties to international agreements could undertake sample surveys of domestic follow-up action subject to agreement by the sovereign States concerned." "...cooperation for training in all areas and at all levels will be required, particularly in developing countries. That training will have to include technical training of those involved in data collection, assessment and transformation, as well as assistance to decision makers concerning how to use such information."

6. Information curation	High quality curation of cultural heritage information.	Regular and high quality curation of cultural heritage information appears to help individuals and organisations seeking cultural heritage information, therefore minimising regulatory pitfalls. Additionally, it keeps cultural heritage information up-to-date assisting in various developmental undertakings and international understanding.	"...integrated data collection and research work of programmes related to desertification and drought problem.." "...regularly updating and distributing information on land classification and land use, including data on forest cover, areas suitable for afforestation, endangered species, ecological values, traditional/indigenous land use values, biomass and productivity, correlating demographic, socio-economic and forest resources information at the micro- and macro-levels, and undertaking periodic analyses of forest programmes."
7. Information exchange	Provide hurdle-free networks for exchange of cultural heritage information at all levels.	Proactive exchange of cultural heritage information creates regional and international understanding, reduces administrative red-tape and keeps developmental undertakings within compliance.	"...regularly exchanging information on marine degradation caused by land-based and sea-based activities and on actions to prevent, control and reduction.." "...in human development strategies through advocacy and promoting information exchange, research, capacity building and cooperation at the regional..." "...strengthen the capabilities, particularly of developing countries, to measure, model and assess the fate and impacts of transboundary air pollution, through, inter alia, exchange of information and training..."
8. Information platforms	Provision of high quality digital platforms to host cultural heritage information (i.e. Europeana).	According to the policy documents and reports, it is highly essential to create more cultural heritage information platforms such as Europeana to ensure accessibility to cultural heritage information. Such platforms offer a variety of benefits such as informing various socio-economic and health regulations, cultural awareness, forming of discussion groups, indigenous affairs promotion, cross referencing cultural heritage information and informing various sciences etc.	"...international, regional and national institutions, particularly in developing countries, to generate and exchange relevant information is limited. An integrated and coordinated information and systematic observation system based on appropriate technology and embracing global, regional, national and local levels is essential." "...should be undertaken: facilitation of access to existing information dissemination systems, especially among developing countries; improvement of such access where appropriate; and consideration of the development of a directory of information." "...programmes to provide information, promote discussion and encourage the formation of management groups."
9. Information quality	Provision of high quality and authenticated cultural heritage information.	Cultural heritage information, according to the reports (listed in Appendix 1) should be comprehensible, authentic, compatible and complete to achieve cultural sustainability.	"The lack of reliable emissions data outside Europe and North America is a major constraint to measuring transboundary air pollution. There is also insufficient information on the environmental and health effects of air pollution" "...and maintain adequate systems for the collection and interpretation of data on water quality and quantity and channel morphology related to the state and management of living aquatic resources, including fisheries;..." "Reliable data and information are vital to this programme area. National Governments, in collaboration, where necessary, with relevant international organizations, should, as appropriate, undertake to improve data and information continuously"
10. Information seeking	Better understanding of the seekers of cultural heritage information to create knowledge and better systems.	A better understanding of the users of cultural heritage information would allow building better services, hence promoting cultural sustainability.	"...development, everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual levels. The following two programme areas need to be implemented to ensure that decisions are based increasingly on sound information." "...national, subregional, regional and international information systems should be developed and linked through regional clearing-houses covering broad-based sectors of the economy such as agriculture, industry and energy. Such a network might, inter alia, include national, subregional and regional patent offices that are equipped to produce reports on state-of-the-art technology. The clearing-house networks would disseminate information on available technologies, their sources, their environmental risks, and the broad terms under which they may be acquired. They would operate on an information-demand basis and focus on the information needs of the end-users. They would take into account the positive roles and contributions of international..."

11. Information sharing	Proactive sharing of cultural heritage information through various means.	Proactive sharing of cultural heritage information contributes towards other types of information such as scientific, health and infrastructure. Additionally, building platforms where international sharing of cultural heritage information is facilitated appears to contribute towards cultural sustainability.	"...to adopt policies and technologies and to exchange information on them in order to enable the construction sector to meet human settlement development goals, while avoiding harmful side-effects on human health and on the biosphere, and, second, to enhance the employment generation capacity of the construction sector." "The appropriation of information and its transformation into knowledge by the citizens is a cultural act. Therefore access without discrimination to expressive, technological and communication resources and the constitution of horizontal networks strengthens and nourishes the collective heritage of a knowledge-based society."
12. Information standardisation	standardisation of cultural heritage information.	Standardisation of cultural heritage information leads to its authenticity and reliability, hence promoting cultural sustainability.	"...continuation of ongoing work for legal data collection, translation and assessment. Closer cooperation between existing databases may be expected to lead to better division of labour (e.g., in geographical coverage of national legislative gazettes and other reference sources) and to improved standardization and compatibility of data, as appropriate."
13. Information transformation	transforming cultural heritage information into potential knowledge in various other disciplines.	Ability to transform cultural heritage information into usable information in developmental undertakings and other scientific disciplines could promote cultural sustainability	"The appropriation of information, and its transformation into shared knowledge, is a cultural act that is interdependent with the lifelong right to education and cultural participation." "....of scientific and technological information and access to and transfer of environmentally sound technology are essential requirements for sustainable development. Providing adequate information on the environmental aspects of present technologies consists of two interrelated components: upgrading information..."
14. Information usage training	creation of training programmes in the usage of cultural heritage information at all levels.	It appears that offering training programmes at various levels can lead to cultural sustainability. Specifically training in the analysis of cultural heritage information (cultural informatics), creating shared understanding through analytics, various types of intelligence and ability to transform cultural heritage information into knowledge for other disciplines contributes to the cause.	"Data analysis, planning, research, transfer/development of technology and/or training activities form an integral part of the programme activities, providing the scientific and technological means of implementation." "Management-related activities should involve collection, compilation and analysis of data/information, including baseline surveys. Some of the specific activities include the following" "Train professionals and planning groups at national, district and village levels through formal and informal instructional courses, travel and interaction"

Table 1. Summary of the identified cultural information practices, their contexts and samples quotations.

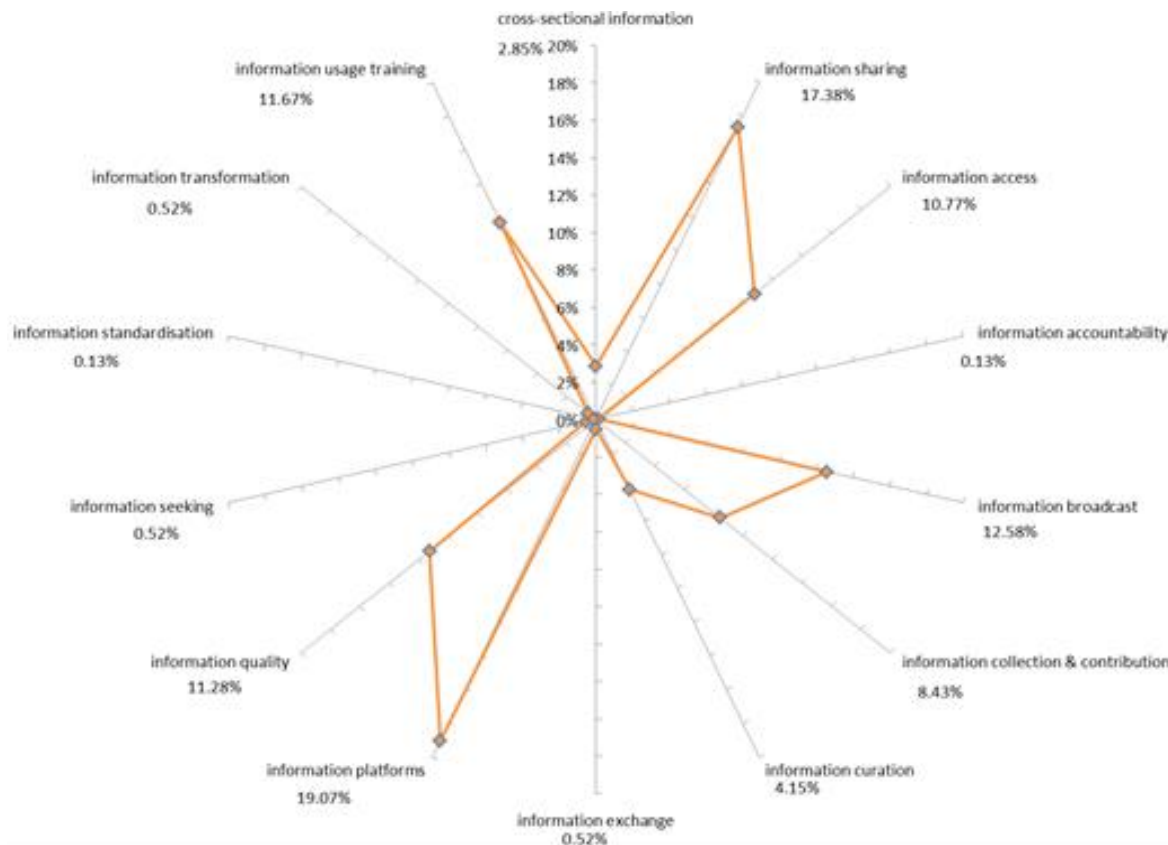


Figure 5. Themes and weightages of cultural heritage information practices necessary to achieve cultural sustainability

Part two - Pedagogy in cultural informatics

The gap analysis framework was applied to study the provision of cultural informatics education at iSchools. The findings are discussed according to the various stages.

Goal setting

Goals for successfully learning various aspects of cultural informatics are the fourteen themes identified in part one of the findings.

Gaps

The courses/ modules taught in the iSchools were mainly technology focussed and excelled in teaching the technological elements of information practices. Additionally, courses/modules also centred around biology, ethics, policy, design, economics, sociology, health, finance, marketing, psychology, legal, library sciences, mathematics and statistics etc. It appears that iSchool's courses/modules are providing necessary pedagogy on the cross-disciplinary applications of information sciences. At undergraduate level, courses were more technology

focussed in computer and information sciences, and 15% of the courses/modules emphasised on other disciplines, mostly limited to electives. At postgraduate level too courses/modules were technology focussed with 12.2% of them emphasising other disciplines, however, only 1% of them were electives. This shows multidisciplinary specialisation in iSchool's courses is higher at postgraduate level than at undergraduate level. At postgraduate research levels (MRes/PhD), specialisation increases further, evidenced by research done in the areas of digital humanities and cultural informatics (Klein & Gold, 2016). Growth in pedagogy in cultural and design informatics, and digital humanities is suggested to trail farther behind the research developments within the field (Klein & Gold, 2016; Clement & Carter, 2017; Poole, 2017). The findings of our research depict a similar picture, especially at undergraduate level. Out of all the courses/modules analysed, 2.3% courses/modules emphasised on arts, culture, heritage and museum informatics as majors. Moreover, specialist courses/modules in the aforementioned fields constituted slightly higher at postgraduate level than at undergraduate level. iSchools in the Asia-Pacific region were significantly more technology focussed and there was very limited emphasis on cultural heritage informatics, despite the region being concentrated highly in various cultures and generally accepted as a cultural melting pot. iSchools in North America and Europe possessed a higher number of courses/modules offering pedagogy in cultural heritage informatics.

Potential causes

In the previous stage a number of gaps have been identified with respect to teaching cultural heritage informatics in iSchools like regional differences, level of study differences and less number of courses/modules focussing on cultural heritage informatics. A number of factors could be causing these differences. There has been a steady increase in students choosing STEM education and focussing on STEM based careers, which has caused less demand for arts and humanities courses (Osbornes et al., 2003; Zakaras & Lowell, 2008), although there seems to be an interest (Borgman, 2009). With less demand and further funding cuts to the arts and humanities, most departments are left to fend for themselves (Bullen et al., 2004). Additionally with a limited employability scope, students prefer more technologically focussed courses (Brown, 2007). Especially in many Asian countries, an arts and humanities degree is seen as inferior (Boyd, 2011). Perhaps, the problem is deeply rooted in a servitude based system, which needs an urgent revision. According to Zakaras & Lowell (2008), it is not an isolated issue, and needs consolidated thinking between policy makers and industries specific to both disciplines for their survival (Hughes, 2011). Arts and humanities education with technological elements

has been labelled as "the neglected step-child" by researchers in digital humanities and one of the reasons appears to be a lack of awareness of how technology contributes to arts and humanities (Klein & Gold, 2016). Additionally, there is less awareness regarding the existent threat of cultural heritage extinction looming society, for both tangible and intangible cultural heritage (Lenzerini, 2011; Forrest, 2012).

Potential solutions and their implementation

Scholars in the digital humanities field indicate a need for more collaboration between technology and humanities in academia (Zilberg, 2018), in addition to increasing the awareness of what both the fields could contribute to each other (Silberman, 2004; Ionnides et al., 2006; Ott & Pozzi, 2008; Marden et al., 2013; Keener, 2015). The onus of creating awareness lies on policy makers as well as academics through public engagement and outreach activities (Zorich, 2008; Higgins, 2011; Alexander & Davis, 2012; Hirsch, 2012). Additionally, outreach activities conducted by cultural heritage management boards and technology partners increased both public and practitioner awareness of how the fields contributed to each other (Dalbello, 2011; Dorner, 2009; Liu, 2012). Digital humanities communities could also bring stakeholders together to work towards its sustainability (Poole, 2013; Sample, 2013; Maron & Pickle, 2014).

Evaluation and current achievement

Currently, many scholars generally agree that pedagogy in cultural informatics and digital humanities has lagged considerably behind research developments (Klein & Gold, 2016; Borgman, 2010), despite its success in some high profile institutions like UCLA, Stanford and Kings College London (Borgman, 2009). Although several institutions around the world are now offering degree programs in digital humanities combined with pure arts and humanities courses, the impact of the pedagogy is unknown. The findings of this study could offer a solution for some of the current issues faced by pedagogy in this area, and indicate the characteristics of a comprehensive learning curriculum in cultural heritage informatics.

Discussion

The first part of this section discusses the various concepts of cultural information practices and their attached contexts to achieve UN SDGs which are embedded within official UN policy documents (RQ1 & RQ2). This is followed by a discussion on the current cultural informatics training available in the iSchools and identification of a core set of information science skills within cultural informatics courses promoting sustainable development (RQ3 & RQ4).

Cultural heritage information practices for sustainable development

The findings indicate fourteen information practices which account towards sustainability of cultural heritage, both tangible and intangible. Seven of these, namely information platforms, information sharing, information broadcast, information quality, information usage training, information access, information collection and contribution appear to be critical to the cause of achieving the SDGs. The findings indicate a clear need to digitise and provide digital information services hosting cultural heritage such as Europeana, to achieve cultural sustainability (Silberman, 2004). Concurrently, there is also a need to share and broadcast cultural heritage information proactively either through cultural heritage information platforms or other means (UNHCR, 2018). Governments around the world should recognise the need and promote building such platforms to host cultural heritage, as they are best placed to encourage the process (Nicholas & Clark, 2013). It was also recognised that ownership of the quality of cultural heritage information is essential to cultural sustainability and further research is needed to define quality in cultural heritage information. This naturally leads to the aspect of collection and contribution of cultural heritage information using different methods, and directed to a single contact point where it can be curated and made publicly available. Conceivably, concerned authorities could follow the Europeana's strategic plans or even better, build collaborations between concerned partners/stakeholders (Hanappi-Egger, 2004). In addition, as identified by recent research projects like NetDiploma (www.northumbria.ac.uk/netdiploma), necessary developments in parallel in ICT infrastructure needs to be implemented to collect, curate, share and making the cultural heritage information accessible, together with the provision of training to use this information. Different types of users should also be identified to understand and improve the functionality of the information (Kuhlthau, 1991). For example, the general public may use this information for educating themselves in a culture, and a researcher could use the metadata for researching specific issues. In addition to helping meet the UN's SDGs, achieving cultural sustainability can hugely benefit a state by improving the conditions of various sectors, as in Figure 1.

The findings indicate various contexts of themes (cultural heritage information practices), which provide a window into the world of application of the discipline. Currently, several oral communication traditions possess intangible forms of indigenous medicine and health practices (Anyaku et al., 2015), which when converted to recorded forms, could be investigated by the researchers to confirm its effectiveness. Similarly, when collected, intangible forms of information about the environment that is available with indigenous communities living around

the world can offer new knowledge to researchers in various disciplines and policymakers to make appropriate development and policy decisions. Cultural heritage information when collected and made available, could also be beneficial to the integration of immigrants and local communities, especially in the current state of affairs, where 68.5 million people worldwide are forcibly displaced due to various factors (UNHCR, 2018). A good example is the Comfrey Project (<http://thecomfreyproject.org.uk/>), which builds immigrant integration in the North-East of England through recording and harnessing the skills of immigrants for the benefit of the local community. In terms of commercialisation, curated and analysed data from cultural heritage could be merged onto Creative Commons to earn copyrights, and further commercial usage. Therefore, the long term implication of this research envisages the empowerment of various academic disciplines, people and communities and the environment etc. as a result of contributions from cultural heritage informatics (Hanappi-Egger, 2004).

Education in cultural heritage information management

The findings indicate that 2.3% of all the courses at different levels focus on museum informatics, arts, culture and heritage, however at postgraduate research level, the percentage appears to be much higher. This finding corroborates previous research (Brown, 2007; Boyd, 2011) which concluded that, although there is an interest in the field of cultural informatics and digital humanities, the learning element of it at higher education institutions appears to grow at a slower rate due to various factors ranging from career prospects to social pressures. Previous research (Dalbello, 2011; Dorner, 2009; Liu, 2012) recommends that a combination of marketing the courses/modules by depicting the nature of cultural heritage informatics, creating awareness by showcasing world class research performed in the discipline and developing a sense of urgency about the threat of culture loss etc. could create interest. The concept of cultural sustainability as the fourth pillar of sustainable development, and the key findings of our research can generate more interest in cultural heritage information education. Many researchers (Silberman, 2004; Ionnides et al., 2006; Ott & Pozzi, 2008; Marden et al., 2013; Keener, 2015) recommend that governments, academics and relevant stakeholders' collaboration are necessary to promote pedagogy in this field. The findings of this paper, along with various ongoing research projects led by UNESCO (see for example, <https://en.unesco.org/gap/partner-networks>) and other research projects (see for example, www.northumbria.ac.uk/netdiploma and <https://www.leapsgcrf.com/>) may lead to the development of a novel curriculum focussing cultural heritage information management, and such novel curriculum can be offered to students in the form of massive open online courses

(MOOCs), which can provide two benefits. MOOCs can be used as an instrument to test the market for the demand of the course/module and secondly, and more importantly, MOOCs will create awareness regarding the interdisciplinary nature of cultural heritage informatics, and thus create generate interest in further education and research (Wang et al., 2014; Zheng et al., 2015; Howarth et al., 2016;). Additionally, MOOCs hugely benefit continuous and lifelong learning programs (Steffens, 2015; Fisher, 2014). The cultural heritage information practices which contribute to sustainability can be categorised under various types of skills, further contributing towards a potential course (Figure 6).

Constituents of a cultural heritage information course

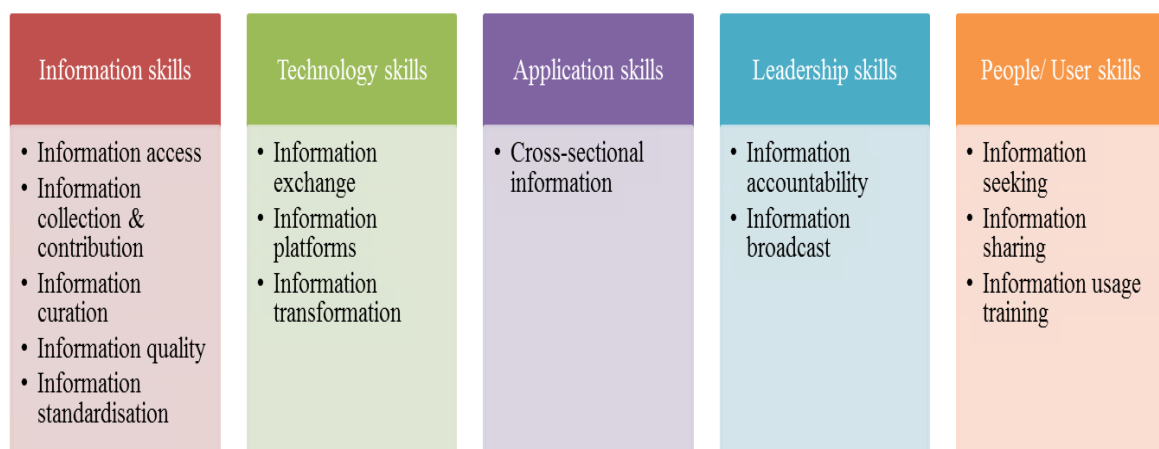


Figure 6. Potential curriculum structure of cultural heritage information course

Conclusion

This study shows that cultural heritage is quite multi-disciplinary by nature (refer to figure 1 and various contexts). Various strands of skills are required to successfully learn cultural heritage informatics. The fourteen information practices for cultural sustainability, found in this study, are classified into information (management) skills, technology skills, application skills, leadership skills and people/ user skills, as depicted in Figure 6. These give an idea of how future courses in the field could be designed. Some of the skills also map onto other categories, for example between the technology and people/user skills. The varied skill-set (figure 7) required to learn the field and potential applications (figure 1 and various contexts) gives an indication that the field is considerably applied by nature.

Recently, several cultural heritage research projects have been funded by the European Commission, e.g. the SASMAP project that aims to survey, preserve and record cultural heritage information from submerged under water objects (shipwrecks, air-crashes, landscapes etc.). This project requires collaboration between researchers in Arts and Humanities, and various applied and pure sciences (SASMAP, 2017). Clearly, the field of cultural heritage informatics is evolving tremendously and requisitions a balanced set of skills from several disciplines at theoretical and applied levels.

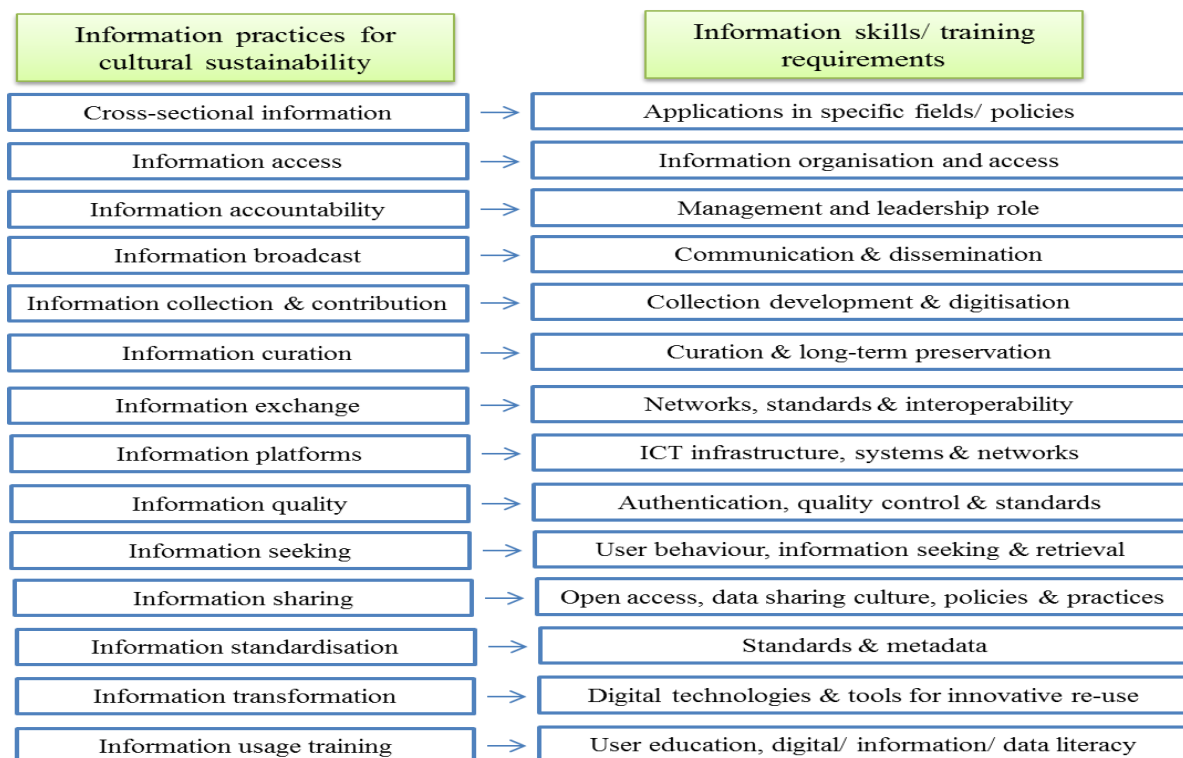


Figure 7. Information skills/ training requirements to embody information practices for cultural sustainability

Although iSchools and various higher education institutions offer courses/modules teaching the required skills, perhaps there is a need to re-think about the curriculum being offered. The information practices identified may be mapped onto some specific information science skills and training requirements. Most of these skills are offered by the iSchools in the context of digital scholarly content and web resources, but not always in the context of cultural heritage information. Figure 7 gives an illustration of the various information practices for cultural sustainability and how they map onto information skills and training offered at various higher education institutions. Overall the research demonstrates a thematic analysis of cultural heritage policy documents can be used to explore the key themes for cultural informatics education and research that can lead to sustainable development. Cultural heritage information

education should cover a series of skills that can be categorised in five key areas, viz. information, technology, leadership, application, and people and user skills.

As the study primarily interprets the assertions made by the UN and national governments, academics and specific subject experts could potentially hold different perspectives on information practices promoting cultural sustainability. In view of the potential differences, it is necessary to address this issue through comparative analysis studies of the possible differences in perspectives and refine the identified practices (Pickvance, 2005; Glaser & Strauss, 2017). Further, taking an interpretivist stance might mitigate the findings, hence a systematic review followed by a qualitative meta-analysis could accurately identify the findings (Petticrew & Roberts, 2008; Card, 2015). The study's second part mainly depends upon the information of the courses offered by iSchools through their websites for the gap analysis. The course/module descriptors in the websites might not comprehensively describe a course/module; therefore full course details should be considered in future investigations.

Many states worldwide, have committed to achieving sustainability by 2030, and with the recent inclusion of culture as one of the primary pillar of sustainability, it becomes essential to take the necessary steps from different disciplines to work towards the cause. iSchools are well positioned to take this opportunity and contribute to the cause by offering not only training in cultural heritage informatics, but also creating awareness and encouraging novel applications and innovations in the field.

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Ethics approval

This research does not require any ethics approval.

Competing Financial Interests

This research work did not receive any funding.

Appendices

Appendix 1: Documents analysed to identify cultural heritage information practices

No.	Document Title	Organisation
1	Culture 21: Actions - Commitments on the role of culture in sustainable cities	Agenda 21 for Culture
2	Culture 21: United Cities and Local Governments- Committee on Culture	Agenda 21 for Culture
3	Agenda 21: United Nations Conference on Environment & Development Rio de Janeiro, Brazil, 3 to 14 June 1992.	UN
4	Advice on local implementation of the Agenda 21 for Culture	Agenda 21 for Culture
5	Cultural indicators and Agenda 21 for Culture	Agenda 21 for Culture
6	Cities, Refugees and Culture: Briefing	Agenda 21 for Culture
7	Culture, Climate Change and Sustainable Development: Briefing	Agenda 21 for Culture
8	Culture, Cities and Identity in Europe	Agenda 21 for Culture
9	Culture: Fourth Pillar of Sustainable Development	Agenda 21 for Culture
10	Why must culture be at the heart of sustainable urban development?	Agenda 21 for Culture
11	Operationalising culture in the sustainable development of cities	Agenda 21 for Culture
12	Agenda 21 for culture in France- State of affairs and outlook	Agenda 21 for Culture
13	Culture 21: Local policies for cultural diversity- executive summary	Agenda 21 for Culture
14	Rio+20 and culture- Advocating for culture as a pillar for sustainability	Agenda 21 for Culture
15	Culture, local governments and millennium development goals	Agenda 21 for Culture
16	Culture and sustainable development: examples of institutional innovation and proposal of a new cultural policy profile	Agenda 21 for Culture
17	Cities, cultures and developments: A report that marks the fifth anniversary of Agenda 21 for culture	Agenda 21 for Culture
18	Agenda 21: Theme- Creativity	Agenda 21 for Culture
19	Agenda 21: Theme- Local policies and diversity	Agenda 21 for Culture
20	Agenda 21: Theme- cultural policies and sustainable development	Agenda 21 for Culture
21	Agenda 21: Theme- Globalisation/Localisation - Glocalisation	Agenda 21 for Culture
22	Agenda 21: Theme- Cultural governance and citizenship	Agenda 21 for Culture
23	Agenda 21: Theme- Cultural indicators	Agenda 21 for Culture
24	Role of culture in achieving millennium development goals (MDGs)	Agenda 21 for Culture
25	Local cultural planning and management	Agenda 21 for Culture

Appendix 2: List of iSchools observed for offering cultural heritage information practices as part of their curriculum.

No.	Region	iSchool
1	North America	University of Arizona
2	North America	University of British Columbia

3	North America	UC Berkeley
4	North America	UC Irvine
5	North America	UCLA
6	North America	CMU: Heinz
7	North America	Cornell
8	North America	Dominican University
9	North America	Drexel
10	North America	Florida State University
11	Europe	Hacettepe University
12	Europe	University of Sheffield
13	Europe	University of Boras
14	Europe	Strathclyde University
15	Europe	Northumbria University
16	Europe	Humboldt University
17	Europe	University of Amsterdam
18	Europe	University College Dublin
19	Europe	Charles University Prague
20	Europe	Bar-Ilan University
21	Asia-Pacific	Sungkyunkwan University
22	Asia-Pacific	Wuhan University
23	Asia-Pacific	University of Melbourne
24	Asia-Pacific	Singapore Management University
25	Asia-Pacific	Yonsei University
26	Asia-Pacific	Renmin University
27	Asia-Pacific	Sun Yat-sen University
28	Asia-Pacific	University of Tsukuba
29	Asia-Pacific	Charles Sturt University
30	Asia-Pacific	University of Waikato