FROM WEB 1.0 TO WEB 4.0: THE DIGITAL HERITAGE PLATFORMS FOR UNESCO'S HERITAGE PROPERTIES IN INDONESIA

DE LA WEB 1.0 A LA WEB 4.0: MAPEO DE LAS PLATAFORMAS DE PATRIMONIO DIGITAL PARA LAS PROPIEDADES DEL PATRIMONIO DE LA UNESCO EN INDONESIA

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Highlights:

- Providing a map of the online presence of UNESCO World Heritage Sites (WHSs) in Indonesia by analysing 180 webpages in English and Indonesian languages.

- Identifying several types of digital heritage websites in Indonesia based on the set of categories.

- Classifying a map of 312 mobile apps dealing with UNESCO WHSs and Intangible Cultural Heritage (ICH) in Indonesia, which were retrieved from Android and iOS platforms.

Abstract:

The advent of information and communication technologies (ICTs) has had and is having a major impact on Indonesian cultural resource management, and on the safeguarding methods of its tangible and intangible cultural heritages. Despite varied levels and visible gaps between rural and urban regions in terms of technology usage, innovative initiatives have been created, which correspond to the needs and expectations of a technology-savvy public. As a starting point, a number of public institutions dealing with tangible cultural heritage (e.g. museums, palaces, temples, World Heritage Sites (WHS)) do use innovative digital tools in order to communicate to various audiences, as well as to enrich visitors' experience, especially taking into consideration young generations. This paper will firstly examine the role of ICTs in intangible cultural heritage (ICH) (e.g. Batik, Wayang puppet theatre, etc.); secondly, the authors will explain how ICTs can help to communicate and promote the values, history, and significances of ICH products, both for locals and tourists, with the goal of raising awareness on cultural identity. However, the knowledge of ICH still requires contacts with its own communities and is vulnerable, as it can be exposed to excessive cultural commoditization through e-platforms. This study aims at giving an overview and some examples of digital interventions for cultural heritage communication implemented by various stakeholders in Indonesia. In addition, this paper analyses to what extent a participatory approach engaging local communities, academics, private sectors, NGOs and the government, can ensure higher levels of effectiveness and efficiency, hence supporting the conservation of UNESCO tangible/ICH in Indonesia. This paper aims at: (1) presenting the development of digital heritage platforms in Indonesia; (2) providing a grid of analysis of digital heritage knowledge platforms dedicated to UNESCO tangible and ICH in forms of websites and mobile apps.

Keywords: participative heritage preservation, digital heritage, intangible cultural heritage (ICH), information and communication technology (ICT), mobile apps, heritage dissemination

Resumen:

La aparición de las tecnologías de la información y la comunicación (TIC) ha tenido y está teniendo un gran impacto en la gestión de los recursos culturales indonesios y en los métodos de salvaguarda de sus patrimonios culturales materiales e inmateriales. A pesar de los distintos niveles y las brechas existentes entre las regiones rurales y urbanas en términos de uso de la tecnología, se han creado iniciativas innovadoras que corresponden a las necesidades y expectativas de un público experto en tecnología. Como punto de partida, algunas instituciones públicas que se ocupan del patrimonio cultural material (por ejemplo, museos, palacios, templos, sitios patrimonio de la humanidad (WHS)) implementan herramientas digitales innovadoras para comunicarse con diverso público y enriquecer la experiencia de los visitantes, especialmente teniendo en cuenta a las generaciones jóvenes. Este artículo examinará primeramente el papel de las TIC en el patrimonio cultural inmaterial (PCI) (por ejemplo, Batik, teatro de marionetas de Wayang, etc.); en segundo lugar, los autores

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explicarán cómo las TIC pueden ayudar a comunicar y promover los valores, la historia y el significado de los productos del PCI tanto al público local, como a los turistas, con el objetivo de crear conciencia sobre la identidad cultural. Sin embargo, el conocimiento del PCI todavía requiere contactos con sus propias comunidades y es vulnerable, ya que está expuesto a la excesiva mercantilización cultural a través de plataformas electrónicas. Este estudio tiene como objetivo proporcionar una visión general y algunos ejemplos de intervenciones digitales en la comunicación del patrimonio cultural adoptadas por diversos organismos interesados en Indonesia. Además, este documento explica en qué medida un enfoque participativo, que involucra a las comunidades locales, académicas, sectores privados, ONG y al gobierno, puede garantizar niveles más altos de efectividad y eficiencia, y, por tanto, apoyar la conservación del patrimonio cultural material/inmaterial de la UNESCO en Indonesia. Este documento tiene como objetivos: (1) presentar el desarrollo de plataformas de patrimonio digital en Indonesia; (2) proporcionar una matriz de análisis de plataformas de conocimiento del patrimonio digital dedicadas al patrimonio cultural material e inmaterial de la UNESCO en sitios web y aplicaciones móviles.

Palabras clave: preservación participativa del patrimonio, patrimonio digital, patrimonio cultural inmaterial, tecnologías de la información y la comunicación (TIC), aplicaciones móviles, divulgación del patrimonio

1. Introduction

The conservation of cultural heritage is varied based on its categories. Cultural heritage, in general, is defined into two types namely, the tangible and the intangible heritage. According to the UNESCO Convention on the World Heritage Sites (WHS) in 1972 (UNESCO, 1972), tangible heritage refers to the physical artefacts, such as architectural works, monuments temples, which are known for their socio-cultural importance for humanity. Other than the historic and artistic values, the assessment of the cultural heritage has not only emphasized on the aesthetic point of view but also evolved by further considering the value of identity, the capacity of the cultural heritage object to interact with memory and the living traditions as the immaterial heritage (Titchen, 1996; Vecco, 2010). In order to tackle the challenges of immaterial heritage conservation, the UNESCO Convention in 2003 on the Safeguarding of Intangible Cultural Heritage (ICH) entered into force in 2006 (UNESCO, 2019). It encourages all its member states to preserve the living traditions or living expressions inherited from the past generations, which are still preserved and practised by the local communities. The elements of the ICH are oral traditions, performing arts, social practices, rituals, festive events, knowledge, and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts (UNESCO, 2019). To improve the conservation of the outstanding universal values of cultural heritage, UNESCO stipulated the "Five Cs" of Strategic objectives namely: Credibility, Conservation, Capacity-building, Communication, and Communities (Albert, 2012). To this extent, the conservation of UNESCO Cultural Heritage, both in terms of tangible and intangible ones, should be directed in preserving and promoting the cultural heritage objects and the living traditions based on the Five Cs outlined above. The rise of Information Communication Technology (ICT) has brought a significant impact on the process of heritage documentation (Blanco, Carrión, & Lerma, 2016). ICT plays major roles in cultural heritage dissemination, as it provides possibilities to showcase cultural heritage information in forms of texts, audio, 2D/3D images, and videos through various digital platforms (Redweik, Cláudiob, Carmob, Naranjoc, & Sanjosé, 2017). It also fosters sustainable heritage tourism which not only contributes to the sustainability of the tangible/intangible heritage but also to the wellbeing of local communities (Cantoni, 2018). The Five Cs strategy is an essential aspect to maintain the sustainability of UNESCO properties, especially in Indonesia. Indonesia –a country located in Southeast

Asia– has charted 18 UNESCO properties both in terms of tangible and ICH (Table 1). The preservation of UNESCO properties has been one of the top priorities for the Indonesian government since the 1990s (Fitri, Ahmad, & Ahmad, 2015). The governmental institutions launched several initiatives aiming at engaging various stakeholders such as private sectors, academicians, start-ups, and local communities in order to increase the public's participation in the heritage conservation activities. The Indonesian government also supports the creation of digital information platforms dedicated to the heritage preservation and increases community capacity building to improve the quality of cultural tourism at World Heritage conservation. This paper aims at (1) presenting the development of digital heritage platforms in Indonesia, and (2) providing a grid of analysis of digital heritage knowledge platforms dedicated to UNESCO tangible and ICH in forms of websites and mobile apps.

Table 1: The number of UNESCO WHS and ICH inscriptions in South East Asia (as per September 2019).

Country	WHS	ICH	Total
Vietnam	8	12	20
Indonesia	9	9	18
Philippines	6	3	9
Cambodia	3	5	8
Thailand	5	1	6
Malaysia	4	2	6
Laos	3	1	4
Myanmar	2	0	2
Singapore	1	0	1
Brunei Darussalam	0	0	0
Total	41	33	74

2. Indonesian heritage conservation: an overview

The management of Indonesian cultural heritage preservation was initiated during the Dutch colonial era in the 18th century. Some of the previous conservation works refer to the three cultural heritage sites which were later inscribed as UNESCO WHS in 1991 and 1996: the Borobudur Temple compounds, Prambanan Temple, and the Sangiran pre-historic site of Java Man

(Pithecanthropus Erectus Palaeojavanicus). The Borobudur and Prambanan temple compounds were founded by Sir Thomas Raffles, a British statesman in 1811-1814 (Aljunied, 2004). The Sangiran pre-historic site was discovered by Eugene Dubois in 1889 (ibid). *Koninklijk Bataviaasch Genootschape van Kunsten en Wetenschappen* (Royal Batavia Society of Arts and Science) was the first museum, which was built in 1778 during the colonial era to conserve the artefacts collection of the Indonesian archipelago (Lewis, 2015). In January 1950, the Indonesian government took over the Royal Batavia Society of Arts and Science. Later in the 1970s, the government decided to change its name into the National Museum that conserves the principal ancient artefacts of Indonesia (Katwinto, 2013).

In effect, the establishment of *Monumenten Ordinantie (MO) Staatsblad* 238/1931 during the Dutch colonial era is regarded as the first heritage legislation in Indonesia (Fitri et al., 2015). In 1945, Indonesian proclaimed its independence and started to follow the heritage preservation protocols and policy guidelines issued by several international agreements. First, at the beginning of 1960s, following the Venice Charter of 1964, the Borobudur temple restoration campaign was launched and supported by ICOMOS (Charter, 1964). Later, the Borobudur restoration project was conducted from 1973 until 1983 and became one of the pilot projects managed under UNESCO Convention for the Protection of Cultural and Natural Heritage in 1972 (UNESCO, 2017). The project also received important international supports in terms of technology transfer, restoration experts, and researches. These assistances contributed to the rise of local initiatives on reviving the cultural heritage at the national level. In 1992, the Indonesian government issued Law no. 5 in 1992 on the assessment criteria of national cultural property (Indonesian Ministry of Education and Culture, 1992). This regulation emphasized the registration and the preservation of heritage for education purposes. However, the legislation has not sufficiently specified the roles and the involvement of the community as one of the key stakeholders who contribute to heritage preservation. Hence, the previous legislation was amended by Law No. 11 of 2010 on cultural heritage conservation. The new legislation highlights the concept of sustainability and strengthens multi-stakeholders engagement in order to maintain the cultural heritage conservation and its outstanding universal values (Indonesian Ministry of Education and Culture, 2010; Praharini, 2014).

Along with the advancement of ICT and the rise of industry 4.0, the Indonesian government improved the legislation by stipulating the Law number 5 of 2017 on Cultural Advancement. The industry 4.0 involves the seamless integration of advanced Information Technology and automation technology within the industrial value chain, which brings on versatile organizational implications (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014; Smit, Kreutzer, Moeller, & Carlberg, 2016). The law is intended to build and improve the cultural database with an integrated cultural heritage registration system, community capacity building, cultural event promotions, and cultural village revitalization in each region (Indonesian Ministry of Education and Culture, 2017). It also views the integration of ICT as a means to facilitate the valorization of the cultural heritage by developing a database containing information of local wisdom, indigenous arts, and fostering cultural education

for youth, as well as promoting tourism and living traditions of the region (Zulkifli & Azhari, 2018). Thanks to this new policy, Indonesian Directorate General of Culture collected a number of online registration entries for 435 museums, 28 cultural parks, and 86425 tangible and ICH across 34 provinces in Indonesia in 2019 (Indonesian Ministry of Education and Culture, 2019). Among them, a total of 41898 of cultural heritage objects and sites have been verified. The Indonesian government also approved 819 ICH nominations that have been proposed by the local government. The central government also increased its financial supports in order to enhance 2001 cultural communities and improve the preservation of 453 indigenous cultural villages that are spread over 34 provinces in Indonesia (ibid).

3. New media to promote virtual communities in digital heritage and tourism

The history of New Media is preceded by the history of human communication across centuries. McLuhan (McLuhan, 1964 as cited in Logan, 2002) classifies the history of human communication into five periods: tribal age (pre-literate), age of literacy, the print age, electronic age, and lastly the new media cultures (Logan, 2002). The electronic age was marked by the invention of television and the radio in 1906. After the digitalization of signals and the birth of multimedia 1980, the development of media technology radically increases the potential range of diffusion and dissemination of information on cultural products (Veltman, 2005). In the era with a high dependency on technology, McLuhan explains that communication technologies become the primary cause of the change in culture. Media technologies play a central role in structuring social arrangements and facilitate broader relationships. Generally, McLuhan explains that technology determination leads to cultural change that shapes the changes in human life and affects the cultural institutions of the community. On the other hand, the opposite pole of technology determinism is social constructivism. Elbanna (2009) states that, "Social constructivism suggests, with different degrees of strength, the importance of the social in shaping the technology, either in use or in production". The two different perspectives lead the way to open a discussion in the Actor-Network Theory, which elaborates the networks of connections between human agents, technologies and objects, as well as global and local networks, as the vehicle of development (Stanforth, 2006). Kéfi & Pallud (2010) further investigate the success of the Actor-Network theory in the field of digital heritage in the museum, which also correlates well with this study. The study on digital heritage dedicated to UNESCO WHS and ICH in Indonesia can be analyzed further with the Actor-Network Theory framework. It could be investigated by looking at the presence of ICTs, in which way they communicate the heritage objects and the stakeholders who produce and promote it (Fig. 1).

Lechner & Schmid (2000) point out that media plays a vital role within the virtual community formation in two possible areas: facilitation and constitution. The study further elaborates that ICT functions as a medium to facilitate communication among the community (Lechner & Schmidt, 2000). In one case, a community or an organization may design a structured communication technology based on the necessities and employ the ICT
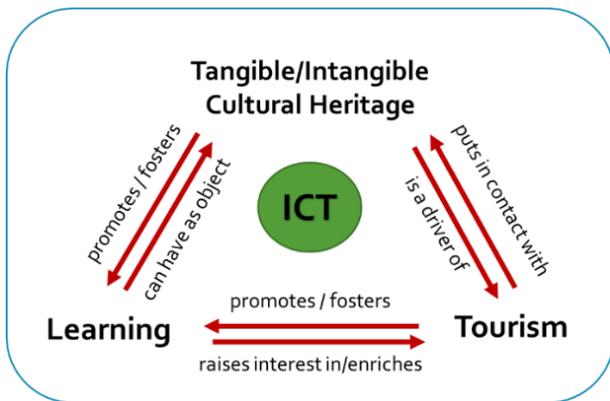
Figure 1: The relation between ICT, Tangible/ICH, and Tourism (Cantoni, De Ascaniis, Marchiori, & Mele, 2016).

to facilitate and foster their communication processes (Cantoni & Tardini, 2006). On the other hand, ICTs may spur the constitution of a community by adopting the same digital communication technology. ICT serves as a medium that is used by the community members to communicate and share experiences (ibid). The advent of ICT facilitates the possibility of people frequently interacting through the world wide web and form virtual communities, discussing their interest in many different fields, including cultural heritage. Tardini (2003) mentions that virtual communities are "a group of people to whom interactions and communications via computer play an important role in creating and maintaining significant social relations". Thus, a community or certain group of people may use ICT as a medium, as it helps to spur the communication or information exchange related to particular interests. Digital technologies can also facilitate the constitution of an organization, as frequent online interaction activities may lead to common logical space and promote activities in the real-world (Lechner & Schmid, 2000; Cantoni & Tardini, 2006).

Since ICTs play a fundamental role in the success of enhancing community awareness on the importance of Outstanding Universal Values, the advent of digital innovations shall not be a threat in fostering the preservation of both tangible and intangible heritage. It must go hand in hand in all ways, not only to be used for promoting the tourism destination of WHSs, but also to raise the awareness of the tourists and local communities to participate in the heritage conservation (Cantoni, 2018). The communication strategy shall be directed to raise the understanding and awareness of different communities in the light of protecting their cultural identity as well as to facilitate local business and thus increase the economic benefits to the local community (Robbins, 2010). To this end, the ICTs innovations shall be localized and adapted to the needs of local society, heritage conservation, as well as bring a sense of empowerment. According to Cantoni (2018), the roles of ICTs in promoting sustainable tourism and the preservation of cultural heritage can be singled out in five main areas:

- **Access**: Widen access & raise awareness; broaden access of information to the relevant stakeholders;
- **Better experience:** Enrich visitor's experience while onsite with digital communication devices such mobile access, location-based services (LBS), Augmented Reality (AR), Virtual Reality (VR), multiple voices, gamification, etc.

- **Connect**: Connect local stakeholders to the heritage (locals with heritage, locals with visitors, visitors with heritage); increase ownership and promote interpersonal encounters through digital storytelling, informal learning, gamification, sharing economy; connecting young generations with their heritage, and empowering them through it, e.g. WHACY (World Heritage Awareness Campaign for Youth) in Southern African Development Community (SADC) where >100000 students involved in «Junior Minister Competition» (Adukaite & Cantoni, 2016); listening to online travel reviews, e.g. Saint Paul Outside the Walls (Rome, Italy) (De Ascaniis & Cantoni, 2013) and Lalibela rock-hewn churches in Ethiopia (Mutinda & Cantoni, 2016); social media campaigns, e.g. #faces4heritage campaign in support of the global #Unite4Heritage UNESCO initiative (Ascaniis, Della Monica, & Cantoni, 2017).

- **Dis-intermediate:** (Dis)intermediate (some) relationships in terms of information distribution, communication support, and promotional activities. ICTs are used in many business activities in order to ensure direct benefits between stakeholders. For example, ICTs for connecting between the museums and the visitors; ICTs for facilitating the visitors with the SMEs and local communities who live at the WHS (Davida & Cantoni 2015).

- **Education:** To facilitate training and education activities to the relevant stakeholders through e-learning platforms, digital archives, MOOCs (Massive Online Open Courses), e.g. MOOC on Tourism Management at UNESCO WHSs vol. 1 that gained >6500 registered learners from 166 countries. (Rosani, De Ascaniis, Gravari-Barbas, & Cantoni, 2018).

3.1. Web technologies

The world wide web, known for its abbreviation the "WWW", was invented by Tim Berners-Lee in the years 1989 and 1990 at CERN (Conseil Européen pour la Recherche Nucléaire –European Organization for Nuclear Research) in Geneva, Switzerland (Berners-Lee, 2000). Through all external hardware such as cables, infrared, satellites, etc., the WWW or the internet connects through Transfer Control Protocol (TCP) and Internet Protocol (IP), which was invented in 1973. This communication protocol (TCP/IP) facilitates the communication between the computer and the systems, and enable all types of data and media (audio, textual, visuals) to be shared between the digital devices. Websites become the most used online platforms that allow broader conversations, interactions and file sharing. It connects all kinds of documents in several accessible online platforms (ibid). According to Webopedia, a website is a site (location) on the WWW. Each website contains a homepage as a landing page where users can find other additional documents and files based on the categories assigned to them (Cantoni & Tardini, 2008). Each site could be owned by an individual, company or organization that manages the site based on the defined communication strategy. The websites represent structured contents whose electronic format text (hypertext) provides links to access the other page on the internet. The internet search engine operates in 3 main activities: by spidering the web, organizing (indexing) submission of websites to the internet database, and responding to the users' queries entered in the search

engine. The internet gathers the related web pages to create a list of web resources and provides users access to a large range of other information resources and media (ibid). Other than websites, other online entries such as newsgroups, social media accounts, images, audio, and videos, blogs, maps, etc. are indexed in the internet search engine.

Based on Cantoni & Tardini (2006), there are two types of websites which are dominating the online presence in the last few years, namely blogs and wikis. Blogs (a short term for weblogs) are defined as a type of online outlet that was originally intended to be used as a personal journal for individual purposes, publicly accessible and regularly updated. Today, the blogs serve as a publication outlet for multiple types of information, whose contents are designed based on the communication goals of the web publisher. As web-based electronic diaries, blogs are very useful tools for one direction micro-publishing, as they usually provide limited discussion or comments on site page (Hall, 2002 as cited in Danesi, 2013). On the other hand, Wikis or wiki is a form of publication outlet, whose name is taken from the Hawaiian word 'wiki wiki' that means 'quick' (Serrat, 2009). The Wikis are collaborative websites that allow users to contribute to building the content or make any changes to the original content (Danesi, 2013).

In 2004, Dale Dougherty introduced web 2.0 as the evolution of the web 1.0 version developed in the 1990s. Web 2.0 is the second generation of the WWW that offers more dynamic and interactive web experiences. It is known as a participative website platform that expands the virtual space for users to collaborate in broader contexts. The platform functions as 'a medium' for sharing information online in forms of posts, comments, inputs via social media, blogging, and websites. It allows users not only to experience more flexible web design, but also facilitates its creative reuse, updates, collaborative and modification of content creations (Murugesan, 2007; Aghaei, Nematbakhsh, & Farsani, 2012). At this point, social media sites such as Facebook, Youtube, Flickr, etc. are commonly used by users. From the development of web 2.0, users may interact with the computer machines to join in a virtual community and its conversation activities such as listening (reading), speaking (writing), and vice versa (Cantoni & Tardini, 2008). Later in 2006, web 3.0 was developed as the third generation of the web 1.0, which marked the birth of Internet of Things (IoT) and the rapid development of mobile service ecosystem (mobile apps) (Atzori, Iera, & Morabito, 2010). Web 3.0 is regarded as a web of cooperation, which operates with two main platforms, namely semantic technologies and social computing environment (Aghaei et al, 2012). It integrates the link and performs discovery and data analysis from various data sets, as well as automation and reuse across multiple applications.

Along with the development of digital technologies outlined above, online users prone to voluntarily contribute and share information or media in forms of text and audiovisual data (images, videos). This interaction of content suppliers and content consumers contributes to the aggregation of user-generated content (UGC) in the semantic web. UGC is a result of pattern recognition over online users' behaviour by recognizing the keywords they use in accessing digital content (Krumm, Davies, & Narayanaswami, 2008). It also implies the generic results of links that are the most referred or accessed by online users with certain keywords (ibid). The most frequented

online platforms, either in forms of websites or mobile apps, may have high user-generated contents that are promoted by the online interactions among online users (O'Hern & Kahle, 2013).

3.2. Mobile apps

The second type of ICTs for cultural heritage is mobile apps. The mobile application is a type of ICT containing a program or software operated on a mobile device (smartphone, Personal Digital Assistant (PDA), etc.). Mobile apps are developed by mobile application developers and publishers. The mobile apps are usually developed to perform one or a few tasks and provide certain functionalities on particular topics based on its objectives or user requirements (Islam, Islam, & Mazumder, 2010; Basole & Karla, 2012).

The study of web 4.0 reached its peak during 2014-2017 (Almeida, 2017). The emergence of web 4.0 also marked the birth of artificial intelligence that fosters interconnectivity and faster performance of human and machine interaction (Aghaei et al., 2012). The symbiotic interaction of users and machine learning in artificial intelligence plays a central role in fostering the development of industry 4.0 (Demartini & Benussi, 2017). Beside cyber-physical systems, the new revolution of industry 4.0 emphasizes cloud-based systems with real-time responsiveness, which are well provided by web technologies 4.0 (ibid). In terms of culture and tourism domain, web 4.0 allows greater participation and collaboration among online user communities. It connects all tourism and heritage stakeholders into global online networks. Destination Management Organizations (DMOs) and tourism-related stakeholders extensively use ICTs to promote tangible/ICH as the cultural attraction of the tourism destination both through websites and mobile applications. Websites and mobile apps become the most used publication outlets when it comes to communicating the cultural heritage and its related aspects (tourism, fashion). The ABCDE (Access, Better Experience, Connect, (Dis)intermediate, Education) theory may help to provide an insight about the use of ICTs in relation to culture and tourism domain, as outlined in the previous section (Cantoni, 2018).

4. The digital converge of Indonesian cultural heritage

The digital convergence of tangible cultural heritage refers to the convergence of technologies, software and categorizing systems in documenting, archiving, as well as mediating cultural heritage (Stuedahl, 2007). It is also defined as the digital transformation of recorded knowledge, documents, and data into electronic information, which leads to broader access and the functional integration of libraries, archives, and museums (Dempsey, 2000 as cited in Marty, 2014; Dabello, 2016). The digital transformation in the field of cultural heritage conservation covers not only in the forms of visualization technologies for documenting archaeological data and related documents but also the ICTs for dissemination and mediation purposes (Redweik et al., 2017). According to the Five Cs UNESCO Strategic Objectives, the dissemination and the mediation of cultural heritage play significant roles in engaging more stakeholders, which in turn, contributes to the continuity and the sustainability of cultural heritage conservation. Thus, more attentions have been paid on how WHSs and its

Outstanding Universal Values (OUV) are presented on and offline. The online presentation of tangible/ICH shall be aimed to foster responsible and respectful behaviour among visitors and raise public awareness about the importance of this heritage (Garbelli, Adukaite & Cantoni, 2017). The digital convergence of Indonesian cultural heritage started by the development of Digital Heritage Network in 1998 as part of the first digital library project initiated by KMRG (Knowledge Management Research Group) of Bandung Institute of Technology in Indonesia (Fahmi, 2002). The following years later, the more and more public institution developed digital heritage platforms, which involved broader stakeholders from private sectors, education institutions, and local communities.

4.1. ICTs for tangible cultural heritage

Since 2010, the use of ICT in Indonesia has started to grow extensively, characterized by the growing number of social media users, the advancement of e-tourism, and financial technology. Based on the Global Digital Report of January 2019 (Kepios, 2019), Indonesian internet users and social media users both reach 56% of the total population which counts as much as 150 million people, compared to 132.7 million internet users in 2017. Indonesia also ranks the 4th country in the world after India, China, and the USA in terms of internet absolute growth rankings. This result shows the dynamic growth of Indonesian virtual communities. Kuswarno (2015) indicates that internet users reach 51% in urban communities and 49% in rural areas. Based on his research, several factors are deemed essential to accelerate the growth of online users in Indonesia, such as software applications, social networks, communication devices and extensive IT infrastructure in rural areas with wider broadband coverage. The Indonesian government also encourages the youth community –including the heritage community– to support national goals to become the Digital Energy of Asia in 2020 by launching national movements of 1000 start-ups creation in 2017. The government also encourages all related stakeholders to support national creative industries and cultural tourism, as well as to foster the preservation of tangible and ICH through digital technologies (Indonesian Ministry of State-owned Enterprises, 2019).

The development of the digital heritage platform in Indonesia was first started by pro bono movements. This initiative corresponds to voluntary work coordinated by a group of Indonesian scientists with the aim to facilitate the development of Indonesian cultural heritage inventory in 2008 (Situngkir, 2010; Avi, 2014). The increasing number of endangered Indonesian artefacts and weak cultural database led the cultural activists to create a significant digital initiative. The first wiki-based website platform (www.budaya-indonesia.org) was created by a group of scientists involved in Bandung Fe Institute in collaboration with Sobat Budaya Cultural Association. In 2011, the initiative was amplified by the launch of a cultural movement called "Towards 1 million Cultural Data Inventory". The goal of this movement was to encourage all stakeholders in order to support the protection of Indonesian tangible/ICH by inviting public participation in enriching the cultural database and registering local heritage into the digital heritage platform (Situngkir, 2019). In 2019, the digital database movement has succeeded in collecting more than 50000 digital cultural

entries submitted by the online contributors across 34 provinces in Indonesia (ibid).

The implementation of law number 5 in 2017 on Cultural Advancement increases the awareness of heritage and tourism-related stakeholders to employ new media technologies. Heritage sites and destination managers are active to promote heritage sites and raise public participation in conservation activities through online publication and advanced web technologies. Digital innovations can be found in some of the UNESCO properties in Indonesia. For example, Borobudur Conservation Center invests in social media marketing and online publications, such as a mobile app, interactive website and other media outlets. The Borobudur interactive website features 360° images, videos, virtual tour of Borobudur temple and provides blogs to promote other cultural tourism offers in the area (Gunarto, 2007; Diarta, 2016).

4.2. ICTs for ICH

ICH is characterized by tacit knowledge shared by the community and maintained as such through intergenerational transmission. As of August 2019, 508 ICH elements of 122 countries were enlisted by UNESCO (UNESCO, 2019). The fundamental aspects of this ICH reside on safeguarding practices, as well as its artistic, historical and cultural related values such as the making process, meanings and philosophy behind each cultural symbol. The intangible heritage underlines the importance of the know-how or savoir-faire and 'in the know' behind each cultural practice. Boily (2004) defines the "in the know" or 'savoir-être' as 'the incorporation of knowledge and the process of know-how'. The tacit knowledge incorporated in the ICH is commonly transmitted by oral traditions and through face-to-face interaction and experiences by local practitioners. ICT intervention on the preservation of living heritage shall be based upon the following principles (Garbelli, 2015):

- **Inclusive**: The public participation through ICTs contributes to social cohesion and encourages a sense of identity and responsibility. It also helps individuals to feel part of one or different communities and foster a sense of belonging. Different stakeholders could take part in building a digital technology platform, cross-cultural storytelling content, and contextual mediation of the living heritage for their society.

- **Representative**: The use of ICTs to document and showcase all kinds of tacit knowledge concerning living heritage. It facilitates users to access the knowledge database regarding the making process, skills, cultural symbols, and philosophies as the elements of the living heritage.

- **Community-based**: ICT helps intercultural dialogue, and encourages mutual respect for safeguarding living heritage. The importance of ICH is not the cultural manifestation itself, but rather the wealth of knowledge and traditional skills, transmitted through ICTs from generation to generation.

The digital interventions should help to alleviate the participation of the society by attracting people in producing their own story of the living heritage based on their own perspective in the form of written or audiovisual narratives. Overall, the functions of ICT intervention in the

field of intangible heritage conservation are as follows: (i) Identify, (ii) Capture, (iii) Transmit, (iv) While maintaining its authenticity (Garbelli, 2015).

Indonesia leverages on its rich living traditions as cultural tourism assets to boost the local economy. The rural tourism development goes hand in hand with the use of digital technologies that play major roles in connecting the local stakeholders, the destination managers with the tourists (Jonathan & Tarigan, 2016). To this end, the local stakeholders could engage academicians, young artists, and communities to make the best use of the ICTs by creating dedicated blog posts, websites, and mobile apps for the living heritage. Such initiative could increase the online presence of living heritage, as presented in the case study of Indonesian Batik textile heritage in relation to Indonesian cultural tourism and digital mediation (Permatasari & Cantoni, 2019a; Rakhmawati, 2016).

5. Methodology

The number of Indonesian digital knowledge platforms has increased in the last recent years, thanks to the continuous support of cultural heritage preservation through the use of ICTs. In order to better understand the digital knowledge platform of cultural heritage existing in Indonesia, this study aims at (i) identifying the online presence of Indonesian WHS and its type of publishers by analysing 180 webpages in English and Indonesian languages, (ii) classifying several digital heritage websites which serve as important cultural heritage knowledge platforms in Indonesia, (iii) providing a map of 312 mobile apps dedicated to WHS and ICH retrieved from Android and iOS platforms. The study is conducted by investigating the type of mobile apps, formats, type of publishers, features and functionalities according to the given indicators.

The study was conducted from 15th July to 15th October 2019 by analyzing 180 web pages and 322 mobile apps in Indonesian and English languages covering 18 UNESCO's properties: nine WHSs and nine ICHs in Indonesia. The research adopts a top-down methodology based on the indicators drawn from the previous studies and bottom-up methods by searching for new possible indicators drawn from the samples and the research experimentation (Lizzi, Cantoni, & Inversini, 2011). The bottom-up approach, according to Chi (1997), allows further discovery and experimentation to get a better understanding of the online narratives of the specific subject at the bottom level.

5.1. Website data collection

The data samples are collected by primarily entering the name of one UNESCO WHSs in Indonesia as the keywords in the search query. For example: "Borobudur Temple Compounds" in English and "Candi Borobudur" in the Indonesian language. Once the query was entered, the Google search engine shows the results of web pages and articles related to the keywords. Only web pages shown on the first page of the search result are examined and classified based on the type of online publishers. The study excludes the links of scientific papers and advertised web pages. The research collects 180 webpages in English and Indonesian as data samples, 90 webpages in Indonesian language and 90 webpages in English one. The collected samples were

analysed iteratively by using grid analysis with the predetermined indicators (Table 2). The indicators used the grid analysis are drawn from the Online Communication Model (Cantoni, 2006), Indonesian tourism and Batik: an online map (Permatasari & Cantoni, 2019a), and online platforms for 3D visualisation of heritage (Statham, 2019).

Table 2: Indicators of website grid analysis.

Type of Publication	Type of Digital Heritage	Features
UNESCO WHS	Top – down approach	Thematic Map
Blogs	Bottom up approach	Thematic blogs
Travel Guides		Simulation
Encyclopedia		Online sources and database
Social Media		3D objects
News & Media		360 pictures
		Virtual tour
Online travel review		Participative cultural database
Tourism Board and Official Bodies		Scientific Rigorous
Association and Foundations		
Research Centers and Museums		
Travel Agency/Tour Operator		
Adhoc Websites		
Others		

5.2. Mobile app data collection

As for the mobile apps, similarly, each name of the UNESCO heritage site/ICH was entered as the keywords in the search query both within the Google Play for Android smartphones, and within the Apple store for iOS mobile devices. All the apps retrieved from Google Play and Apple Store were examined and identified based on the relevant indicators. The main indicators were set based on the triangulation of the Online Communication Model (Cantoni, 2006), mobile apps dedicated to WHSs (Schieder, Adukaite, & Cantoni, 2014), mapping mobile apps on Batik ICH (Permatasari & Cantoni, 2019b), and online platforms for 3D visualisation of heritage (Statham, 2019). The apps that operate in two different platforms (Android and iOS) are counted as one single app in the grid analysis. After identifying each name of WHSs and the year of its inscription, each mobile app was analysed according to the following set of indicators (Table 3).

5.3. Grid analysis

The study combines the qualitative method of content analysis with the quantitative assessment in order to

Table 3: Indicators of mobile apps' grid analysis.

Categories	Sub categories	
1. No. apps	1.1. Android (An.)	
	1.1. iOS	
2. Type of mobile apps for WHS	2.1. Encyclopedia	
	2.2. Travel	
	Games (Quiz, animation)	
	2.3. Mix Reality (AR/VR)	
3.Type of mobile apps for ICH	3.1. Encyclopedia	
	3.2. Multimedia	3.2.1. Videos Entertainment
		3.2.2. Fashion
		3.2.3. Image Catalogues (textile, heritage objects)
		3.2.4. Music Instruments
	3.3. Games	3.3.1. Quiz
		3.3.2. Animation games
	3.4.Mix Reality (AR/VR)	
4. Type of publishers	4.1. Association	
	4.2. Independent developers	
	4.3. Media agency	
	4.4. Companies	
	4.5. Research institutes and museums	
5. General information	5.1. General description of the app	
	5.2. History of the site	
	5.3. Geography of the site	
	5.4. Philosophical values of the place	
	5.5.Tourism information (maps, transportation, accommodation)	
6. Information on UNESCO WHS/ICH	6.1. Information on WHS	
	6.2. Information about UNESCO convention 1972	
	6.3. Year of inscription	
	6.4 Explicit reason of inscription	
7. Language	7.1. Indonesian	
	7.2. English	
8.Formats	8.1. Text	
	8.2. Photo gallery/slide show	
	8.3. Audio material	
	8.4. Video material/YouTube channel	
9.Features	9.1. Games with animation	
	9.2. Quiz games	
	9.3. Interactive tools	
	9.4. Scientific content	
	9.5. AR	
	9.6. VR	
	9.7. 360 and virtual tour	
	9.8. Sharing by users	
10. No. downloads	10.1.10-50 downloads	
	10.2. 100+	
	10.3. 500+	
	10.4 1000+	
	10.5. 5000+	
	10.6. 10000+	
	10.7. 50000+	
	10.8. 100000+	

analyse the presence of a given type of content in a given set of data (webpages, mobile apps) (Cantoni, Faré, Bolchini, & Giulieri, 2007). The qualitative method was conducted by analysing each app, both in terms of the contents and the features provided. This analysis is intended to identify the presence of each type of content and annotate them into the relevant indicators (Figure 2). The table of indicators consists of the main indicators, which are taken from the previous scientific works, together with additional indicators that emerge during the qualitative analysis process (ibid).

Figure 2: The grid analysis of the online presence of Indonesian WHSs: websites and mobile apps.

The quantitative process was done to clarify the qualitative judgment by assigning the grid value of "1" when the indicator is present. Otherwise, the value of "0" was given when it is absent. These qualitative-quantitative analysis processes are performed on the dataset until thematic saturation was reached (Permatasari & Cantoni, 2019b).

6. Results

6.1. Indonesian WHS online presence

Based on Google organic results, the three most frequent type of publishers covering Indonesian WHSs in the English language (n=90 webpages) are 'UNESCO WHS' (14%), Blogs (14%), and Travel Guides (14%) of the total webpages. The result also shows the active roles of international tourists and travel guides to discuss Indonesian WHSs online, indicated by the good presence of blogs and travel guides site pages.

The analysis conducted on 90 Indonesian webpages shows that 'Social Media' (23%) and 'News and Media' (22%), and 'Encyclopedia' (18%) are the three common online platforms presenting the Indonesian UNESCO WHSs (Figure 3). The high presence of 'social Media' shows active participation of the Indonesian public towards their national heritage. The outcome also indicates the strong support from 'News and Media' agencies who produce creative and informative content about Indonesia WHS. The digital encyclopedia is shown as one of the highest user-generated contents on Indonesia cultural heritage.

In terms of digital heritage platforms, there are several websites which are dedicated to disseminating cultural knowledge as well as to provide access for the public for learning the Indonesian cultural heritage. Table 4 presents the lists of the digital heritage platforms, which

Figure 3: Online presence of Indonesian WHSs.

Table 4: Classifications of common Indonesian digital heritage websites.

Name of Websites	Platform Manager	Features
Top-down approach		
www.perpusnas.go.id	Government and national library	Thematic Map
www.kebudayaanindonesia.net		Online database (manuscripts, ebooks, etc)
www.situsbudaya.id/	Media Agency	Thematic blogs
www.museumnasional.or.id	Museums	Thematic blogs
www.museumkaa.indonesiaheritage.org		3D objects
		360 pictures
		Virtual tour
Participative – bottom-up approach		
www.budaya-indonesia.org	Research Center	Participative blogs
https://www.kairaga.com	Cultural Association of Indonesian Ancient Letters	Thematic maps
		Ancient Letter Simulation
www.aksakun.org		Thematic blogs
www.indonesiakaya.com	Foundation	Participative cultural database
		Thematic blogs

are managed by the government, museums, and national library and other heritage stakeholders. The digital heritage platforms are also classified based on their approaches in communicating the website, e.g. top-down and bottom-up approaches. Some of these digital heritage platforms are managed by public initiatives and media agencies (Figure 4). Such efforts give rooms for broader online users' participation in terms of enriching cultural database and contents related to cultural information. These sites are administered by certain

expert committees, as they are also in charge of editing and verifying the information submitted by the users (Situngkir, 2019).

Figure 4: An example of participative digital heritage platform run by the public initiative. www.budaya-indonesia.org

6.2. Indonesian WHS mobile apps' presence

The study collects a total of 13 mobile apps, consisting of nine Android mobile apps and four mobile apps in iOS. The result shows that only four out of nine Indonesian WHSs that have dedicated mobile apps. All collected samples are classified as one single mobile app that only operates in one single platform (Android/iOS). This study is done by investigating all mobile apps retrieved from the two mobile app platforms into the grid of analysis. Table 5 reveals mobile apps' functionalities based on major categories, e.g. encyclopaedia (five apps), travel guide (four apps), and games/AR/VR (four apps).

Table 6 shows detailed information about the type of publishers. Independent developers are the most frequent publishers of the studied mobile apps. Few of them are produced by 'Research Centre and Museum, 'Association', and 'Tech Company'. In terms of the number of downloads, five out of 9 Android apps dedicated to Indonesian WHS gain 100+ downloads. There is only one animation game app called Prambanan education game, which gained popularity and crossed >100000 downloads.

Table 7 indicates that all mobile apps provide general information and geographical information. Even though most of them do cover the history and related information about the cultural heritage, however, the inscription and other relevant information about UNESCO WHSs, are scarcely mentioned. Nine mobile apps do present tourism information at WHSs, such as transportation, maps, hotels, and attraction highlights. In terms of engagement, the study captures the number of downloads on Android mobile apps.

Table 8 shows the number of mobile apps that provide additional features such as AR, VR, and game animation. It also presents detail classification about the type of formats (video, photos, audio materials) and the number of apps with qualified scientific content. The "Interaction tool" indicator in the analysis is related to additional console features for gamification built in the mobile app. Figure 5 illustrates an example of storytelling mobile app of Prambanan Temple Compounds. This mobile app provides interesting animation, audio material, textual information, and games. Figure 6 presents an example of Borobudur mobile app that features 3D images and virtual tour navigation.

Table 5: Classification of mobile apps dedicated to Indonesian WHSs (Android ≡An.).

No	WHSs	Year of Inscription	Operating system (OS)		Type of mobile apps		
			An.	*iOS*	*Encyclopedia*	*Travel*	*AR/games/VR*
1	Borobudur Temple Compounds	1991	3	3	2	3	1
2	Komodo National Park	1991		1		1	
3	Prambanan Temple Compounds	1991	3		2		1
4	Ujung Kulon National Park	1991					
5	Sangiran Early Man Site	1996	3		1		2
6	Lorentz National Park	1999	-	-	-	-	-
7	Tropical Rainforest Heritage of Sumatra	2004	-	-	-	-	-
8	Cultural Landscape of Bali Province:the Subak System as a Manifestation of the Tri Hita Karana Philosophy	2012	-	-	-	-	-
9	Ombilin Coal Mining Heritage of Sawahlunto	2019	-	-	-	-	-
	Total sum		9	4	5	4	4
	Total mobile apps in An. and iOS		13		13		

Table 6: Classification of type of publishers and the number of downloads (WHS mobile apps).

Type of publishers	OS		No. downloads	No WHS apps (An.)
	An.	*iOS*		
Association	1	-	10-50 dl	2
Independent developers	5	4	100+	5
Companies	1	-	500+	1
Research institutes and museums	2	-	1000+	-
Total	9	4	5000+	-
			10000+	-
			50000+	-
			100000+	1

Table 7: Results on general information and information about UNESCO WHSs (the sum does not always correspond to 100% since all indicators presented in the table are not mutually exclusive).

General information	No. apps	Information about UNESCO WHS	No. apps
General description of the app	13	Information on WHS	10
History of the site	12	Information UNESCO/ UNESCO convention 1972	3
Geography of the site	13	Year of inscription	1
philosophical values of the place	3	Explicit reason of inscription	1
Tourism information (map, transportation, accommodation)	9		

Table 8: Results on formats, language, and features (the sum does not always correspond to 100% since all indicators presented in the table are not mutually exclusive).

Formats	No. apps	Features	No. apps
Text	10	Games	2
Photo gallery/slide show	6	Augmented Reality	1
Audio material	3	Virtual Reality	2
Video material/Youtube channels	-	Animation	1
		Interactive tools	3
Language		Scientific content	4
Indonesian	9	360/Virtual Tour	2
English	4	Sharing by users	4

Figure 5: Example of an educational mobile app of Prambanan Temple Compounds. The app presents the storytelling about the history of Prambanan Temple and the folktale of Princess Roro Jonggrang and Prince Badung Bondowoso (Studio, 2018).

Figure 6: Example of virtual tour mobile app dedicated to Borobudur Temple Compounds. It is equipped with two interaction features for navigating the view of Borobudur through the screen (Indonesia 3one3, 2019).

6.2. Indonesian ICH mobile apps' presence

The study finds 299 mobile apps dedicated to Indonesian ICH in the Android platform. Such findings show a higher interest of the Indonesian public towards the mobile apps dedicated to preserving the living traditions. The study also finds that 10 mobile apps operate in both Android and iOS platforms. Since similar apps are counted as a single app, hence, the study only takes the mobile apps collected from the Android platform. Seven out of nine Indonesian ICH have dedicated mobile apps, namely Indonesian Kris traditional dagger, Wayang puppet theatre, Indonesian Batik wax-resist dyeing textile heritage, three genres of Bali traditional dances, and Pinisi, the art of boatbuilding in South Sulawesi. The list of mobile apps is outlined in Table 9.

Table 9: Classification of mobile apps dedicated to Indonesian ICH.

No	Name of ICH	Year of Inscription	No. mobile apps	
			An.	iOS
1	Indonesian Kris traditional dagger	2008	6	-
2	Wayang puppet theatre	2008	110	-
3	Indonesian Batik wax-resist dyeing textile heritage	2009	164	4
4	Education and training in Indonesian Batik ICH	2009	*items number 3&4 are related to the similar type of ICH	
5	Indonesian Angklung	2010	10	3
6	Saman dance	2011	-	-
7	Noken woven handcraft of the people of Papua	2012	-	-
8	Three genres of traditional dance in Bali	2015	5	3
9	Pinisi, art of boatbuilding in South Sulawesi	2017	4	-
	Total		299	10
	Total apps in Android and iOS		309	

The major type of publishers shown in Table 10 is mostly independent developers. The apps created by independent developers accounted for 51% of the total mobile apps or 151 mobile apps (n=299). The second biggest type of publisher is new and media stakeholders who published 96 mobile apps or 36% of the total samples. In terms of the number of downloads, we assumed that mobile apps for Indonesian ICH draw much bigger engagement than those of the WHSs. For example, there are 32% of the total apps (95 mobile apps) which gain more than 1000 downloads. In addition, 70 mobile apps or 23% of total mobile apps gain more than 100 downloads. The "Pazia Angklung" music instrument mobile app achieves the highest number with more than 100000 downloads on Android (Pazia, 2012).

Table 10 provides the number of mobile apps based on the major clusters and its subcategories. In terms of apps' purposes, the research identifies 22 mobile apps that serve as an encyclopaedia and provide quality content about the history and the knowledge behind the Indonesian ICH.

Table 10: Classification of type of publishers and the number of downloads (ICH mobile apps).

Type of publishers	No. apps (An.)	%	No. downloads (Google Store)	No. apps (An.)	%
Companies (IT company, SMEs)	34	11	10-50	70	23
News and media	96	32	100+	70	23
Research centre and museum	18	6	500+	18	6
Independent developers	151	51	1000+	95	32
Total	299		5000+	24	9
			10000+	18	6
			50000+	3	1
			100000+	1	0.1
			Total	299	100

Table 11: Classification result of type of publishers and the number of downloads (ICH mobile apps).

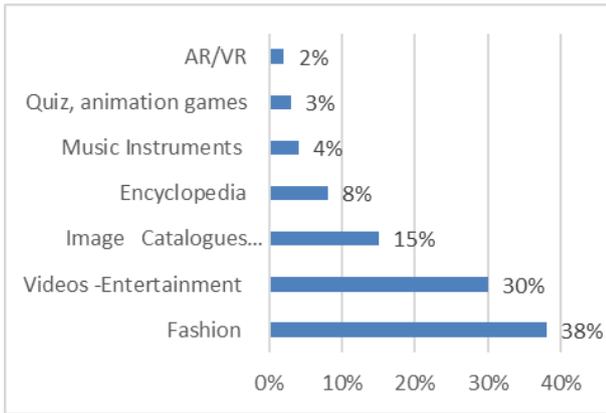| No.	Category	Subcategory	No. apps (An./iOs)	%
1	Encyclopedia	Encyclopedia	22	8
2	Multimedia	2.1. Videos - Entertainment	88	30
		2.2. Fashion	115	38
		2.3..Image catalogs (textile, heritage objects)	45	15
		2.3.Music instruments	13	4
3	Games	Quizzes and animation games	10	3
4	Mix Reality	AR/VR	6	2
	Total		299	100%

Figure 7: Types of mobile apps dedicated to Indonesian ICH (n=299).

Table 11 shows a much high presence of multimedia apps, in comparison to the number of encyclopaedias and games apps. The percentage of each indicator is presented in Figure 7. The study finds 88 mobile apps that are dedicated to showcasing Indonesian Wayang Puppet performance. Wayang is an ancient form of storytelling of wisdom, religious values, and ancient epics. It is originated from the Indonesian Java island, existed since around 15 BC. It was inscribed in UNESCO's Masterpiece of Oral and Intangible Heritage of Humanity in 2008. Its performance involves various repertories, musical accompaniments consisting of bronze instruments and gamelan drums. The Wayang performance is conducted and led by the master puppeteer, or Dhalang. He performs the shadow theatre by manipulating the puppets with compelling storytelling of ancient epics and spiritual wisdom. The Dhalang profession is one of the most prestigious cultural professions in Indonesian, given their talents and abilities (Boonstra, 2014). They are able to conduct Wayang performance in a way that is entertaining the audience with senses of humour, teaching wisdom and life lessons conveyed through Wayang stories repertory (ibid). In this case, the ICT in forms of mobile apps also serve as digital tools for the Dhalang, or the master puppeteer to maintain their connections with their loyal viewers or fans. These apps do contain video materials/YouTube channel of Wayang performances, as well as some textual information about the Wayang characters. Besides, it also provides the users with access to watch the audiovisual recordings of Wayang performances conducted in many cities on Java island. Figure 8 presents an example of a mobile app for Wayang that provides educational contents and interactive games.

The second subcategory of 'Multimedia' is the fashion mobile apps for Batik textile heritage (Table 11 and Figure 7). Batik is a textile made by using the wax-resist dyeing technique and decorated with intricate patterns incorporating socio-cultural importance of Indonesian society. The Batik textile permeates in the life of Indonesian society as a symbolic textile used in every social occasion such as spiritual ceremonies for the religions, the birth, the wedding, the death, as well as the outfits for the royals or public figures (UNESCO, 2009b). UNESCO recognised two nominations of Batik under the List of ICH of Humanity, namely 'Batik safeguarding practice' and 'Education training of Batik intangible cultural heritage' (UNESCO, 2009a). Since the two nominations refer to Batik ICH, no differentiation was

Figure 8: Example of an educational game for Wayang Puppet Theater. The game provides not only informative content about the character of wayang figures, but it also provides the personalization in terms of storyline and figure choices (Surakarta, 2016).

made within the mobile apps' analysis. The mobile apps for the fashion category are explicitly intended for fashionistas to get inspirations and ideas about Batik clothing designs for men, women, family, and traditional gowns (Permatasari & Cantoni, 2019b). The apps also provide suggestions in terms of modern and traditional wearing rules of Batik textile. Figure 9 presents an example of Batik encyclopedia app, called Map of Batik. It depicts more than 500 Batik motifs across Indonesian archipelago (Situngkir, 2011).

Figure 9: Example of encyclopedia map for Batik intangible heritage (Situngkir, 2015).

The third subcategory of multimedia (Table 11 and Figure 7) is related to the mobile apps which display images catalogue of the heritage objects. For example, the images related to Batik textile patterns, the Javanese

Keris traditional dagger, the figures of Wayang theatre puppets, and the Pinisi boat of South Sulawesi. The fourth subcategory is addressed to mobile apps that serve as a learning app for Indonesian Angklung traditional instruments. Angklung is a bamboo traditional music instrument that can be played by single and multiple players. Since one angklung instrument only represents one tone of melody, so in a musical ensemble, one player is responsible for producing a sound/tone through an angklung s/he carries. An expert player can play multiple instruments at once producing a harmonious melody according to its musical arrangement. The mobile apps for angklung are designed with various user interactions to produce audio outputs. For example, some apps do provide functionalities to produce angklung tone by shaking the mobile device. Some other mobile apps allow possibilities to play multiple angklung instruments by screen touch interactions (Figure 10). Other than mobile app for learning musical instruments, it exists a mobile app that provides a complete tutorial for learning traditional Bali dance (Figure 11).
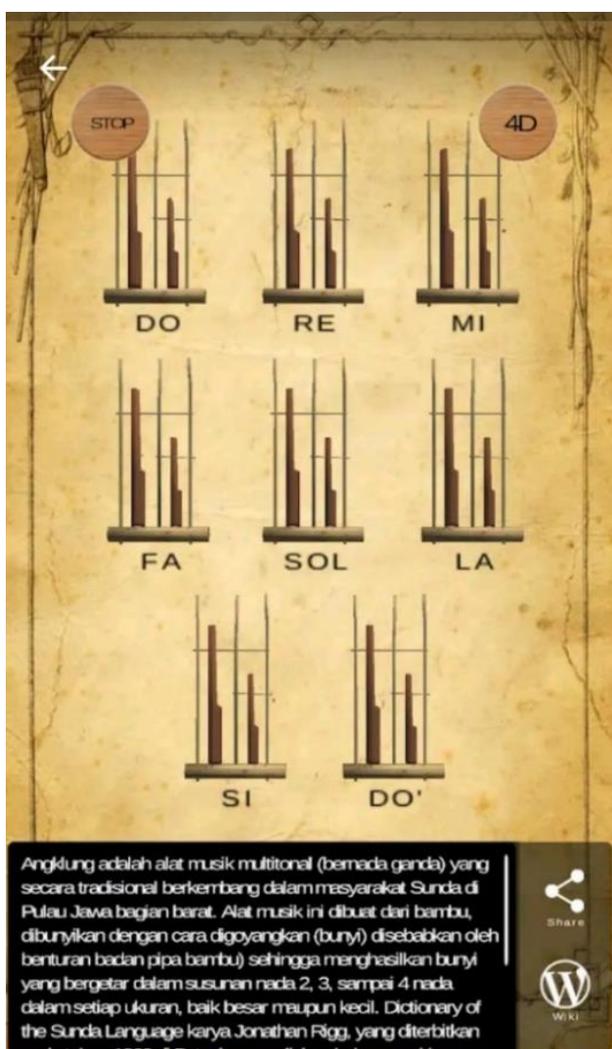

Figure 11: Example of a mobile app for learning Bali dance. The app presents the tutorial of Bali dance step by step (Arya IT, 2016).

Figure 10: Example of educational mobile app for Angklung traditional music available on Google Play. The app presents information about Angklung history and 3D image that can be played by the user. The user may touch or shake the phone to produce the sound of Angklung (Raza, 2016).

As seen in Table 12, all mobile apps provide general information about the app (n=299). Within the general information, 37% of the total mobile apps mention History of the App, 34% provide information on Geography of the concerned WHS/ICH, 38% indicate philosophical values of the WHS/ICH, and 12% suggest tours at WHS or visit galleries of ICH. In terms of mobile apps for ICH, the result shows a good number of mobile apps (66%) that provide information concerning historical aspects and philosophical values of the ICH in apps' general information. On the other hand, only 6% of the total mobile apps state explicit information about UNESCO WHSs and safeguarding goals.

Table 13 indicates the details of formats and features provided within the mobile apps. The majority of mobile apps (84%) display the collection of images and slide shows. 32 % of the mobile apps are equipped by audio material such as recordings and voice over for games, AR, VR, and encyclopaedia. 20% of the total samples display long textual information within the encyclopedia apps, education games and AR. Many apps classified in Multimedia apps (video entertainment, fashion, images catalogues, and music instrument) as presented in Table 11, only display titles, images, and audiovisual contents, without providing qualitative written information. The result shows 88% of mobile apps samples dedicated to ICH are in the Indonesian language and the rests are in English. The study also finds that ICH is promoted in various types of digital technologies. The study finds that 11 mobile apps for ICH are equipped with fascinating animation and games apps. Some games provide quizzes and additional control menu to personalise or choose characters (Table 13). Those apps also provide immersive features such as AR and VR. The research observes that 13% of the total mobile apps can be used as e-learning tools, as they do provide scientific contents

about history, philosophy, or other specific information about the ICH objects. The apps present scientific content in different modes and formats, such as through textual information, games, pictures, AR, and VR.

Table 12: Results on general information and information about UNESCO ICH (the sum does not always correspond to 100% since all indicators presented in the table are not mutually exclusive).

General information	No. apps	%	Information about UNESCO ICH	No. apps	%
General description of the app	299	100	Information on ICH	197	66
History of the object	112	37	Information about UNESCO ICH convention 2003	17	6
Geography of the WHS/ICH	101	34	Year of inscription	12	4
Philosophical values (identity, moral, sacred)	113	38	Explicit reason of inscription	13	4
Suggested tour(s) at WHS or Galleries of ICH	36	12	Safeguarding goals	19	6

Table 13: Results on formats, language and features in ICH mobile apps (the sum does not always correspond to 100% since all indicators presented in the table are not mutually exclusive).

Formats	No. apps (An.)	%	Features	No. apps	%
Text	60	20	Games with animation	11	4
Photo gallery/slide show	250	84	Quizzes	3	1
Audio material	97	32	Interactive tools (game console, character options)	16	5
Video material/You Tube channel	10	3	Scientific content	40	13
Languages			Augmented Reality	3	1
Indonesian	262	88	Virtual Reality	3	1
English	37	12	360 and Virtual tour	4	1
			Sharing by users	164	55

5. Conclusion

The study captures the journey of Indonesian society to preserve the UNESCO WHSs and ICH from the 19th century until the digital era 4.0. Since the beginning of the 2000s, the rise of ICTs brought significant impacts in fostering the growth of internet users and the creation of digital start-ups in Indonesia. Facing the critical challenge of heritage conservation, digital heritage platforms become an undeniable solution to raise public engagement, to disseminate cultural heritage values and its conservation aspects, as well as to promote sustainable tourism at the heritage sites. By analysing 180 webpages and 322 mobile apps through the lens of the online communication model and related studies, this research has contributed to providing an online map of UNESCO WHSs and ICH in Indonesia. The result shows that Indonesian digital heritage platforms are developed both by top-down approach and bottom-up approaches. The governmental support in terms of facilitation and policy guidelines combined with the strong local initiative helps the expansion of digital heritage platforms such as online cultural database websites, blogs, and mobile apps. The study reveals that in terms of addressing the English audiences, the online presence of Indonesian WHSs is mostly referred through UNESCO WHS official website and travel-related webpages for English audiences. The encyclopaedia is one of the most common types of publishers when it comes to covering the cultural heritage in the Indonesian language. Therefore, it is deemed important to provide informative and educative content within the ICTs for heritage and tourism, in order to improve the capacity of the local stakeholders and to raise the awareness of international tourism towards the conservation of the heritage. In terms of mobile apps, most of the developers are coming from private sectors consisting of independent developers, tech companies, the research centres, and museums. We assumed that the high presence of mobile apps and the number of downloads illustrated in the study indicate a certain level of enthusiasm from Indonesian online users regarding the dissemination of cultural heritage through ICTs. Such tendencies would bring beneficial impacts to the improvements in cultural heritage conservation in the future. In terms of the number of mobile apps, the Borobudur and the Prambanan Temple Compounds are the only two sites among all UNESCO WHSs in Indonesia that possess several dedicated mobile apps. As for the UNESCO ICH, the study also records a huge number of mobile apps in relation to Batik and Wayang puppet theatre. This research finds that some mobile apps offer innovative ways of communicating cultural heritage through interactive quizzes, gamification apps with animation, AR/VR, etc. Since the scope of the research is only limited to analyse the online presence of WHSs in Indonesia, this study can be improved by further research, such as the online presence of Indonesian ICH. This study focuses on the analysis of the type of publishers, contents, and functionalities of mobile apps dedicated to UNESCO WHSs and ICH. Therefore, the research could be expanded to other topics such as usability, apps' user experiences, as well as the content analysis of the users' comments on both Android and iOS platforms. Such researches may give a theoretical contribution that can be used to assess the quality of the apps. As the research shows that only a few apps communicate the UNESCO related information and safeguarding goals, it is deemed important to define a standard content requirement when it comes to communicating good quality messages about

the cultural heritage through digital technologies. It should be noted that the issue of cultural heritage is not only related to local identity but also related to socio-cultural sustainability, which implies shared responsibilities among stakeholders. It is necessary for the Indonesian government to maintain the inclusion of local communities, educational institutions, media, and tourism-related stakeholders in the creation of ICTs for culture and heritage. It is also suggested that each UNESCO tangible and ICH in Indonesia could have at least one or a number of representative mobile apps.

Those apps would be valuable to facilitate and better promote the cultural importance and to support the cultural communities of the concerning heritage.

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