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## Capturing the City's Heritage On-the-Go: Design Requirements for Mobile Crowdsourced Cultural Heritage

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Article

# Capturing the City's Heritage On-the-Go: Design Requirements for Mobile Crowdsourced Cultural Heritage

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**Abstract:** Intangible Cultural Heritage is at a continuous risk of extinction. Where historical artefacts engine the machinery of intercontinental mass-tourism, socio-technical changes are reshaping the anthropomorphic landscapes everywhere on the globe, at an unprecedented rate. There is an increasing urge to tap into the hidden semantics and the anecdotes surrounding people, memories and places. The vast cultural knowledge made of testimony, oral history and traditions constitutes a rich cultural ontology tying together human beings, times, and situations. Altogether, these complex, multidimensional features make the task of data-mapping of intangible cultural heritage a problem of sustainability and preservation. This paper addresses a suggested route for conceiving, designing and appraising a digital framework intended to support the conservation of the intangible experience, from a user and a collective-centred perspective. The framework is designed to help capture the intangible cultural value of all places exhibiting cultural-historical significance, supported by an extensive analysis of the literature. We present a set of design recommendations for designing mobile apps that are intended to converge crowdsourcing to Intangible Cultural Heritage.

**Keywords:** Intangible cultural heritage; Sustainability; Mobile crowdsourcing

## 1. Introduction

The many intangible objects that are part of a city's cultural heritage compose what is known as Intangible Cultural Heritage (ICH) [1]. ICH goes beyond factual aspects of a city's relics. It extends to and includes citizens' memories, thoughts, stories and events that have occurred at a specific location in time. The lack of physical substance is what makes an intangible object less visible and identifiable than a material one. The digital documentation of these abstract stories offers an optimal solution to the intent of recording what would be at risk to be lost from collective memory [2]. The ubiquitous nature of mobile technology [3], e.g. in the form of smartphones, makes designing mobile applications that capture and document novel and old information, a rather attractive solution [4].

Before ICH can be disseminated to a network of users, it needs to be uploaded by the users themselves. One of the crucial aspects for an application to be sustainable and attractive is the embedded capability of attracting new users and retaining existing ones [5]. An ideal ICH framework would be effective at both acquiring and retaining users by intrinsically motivating them in a continuous way. In this paper we present an extensive analysis of the following mobile design guidelines and research questions for ICH:

- Which geo-located technological features can help us capture intangible cultural heritage?
- How can people be best motivated to use these features and contribute towards new and existing ICH content?

## 2. What is Intangible Cultural Heritage (ICH)?

The term Intangible Cultural Heritage was first defined [1] as:

*“The practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity” [1].*

ICH is a concept consisting of three interdependent and intertwined parts of equal weight. The term intangible, meaning the entity that cannot be touched, refers to people’s memories, stories, activities which occurred at a certain point in time, and/or at specific places, including the individuals linked to those memories, stories, and geographical areas. Often, these places correspond to monuments, groups of buildings and sites that are considered tangible [6], but have a cultural value that extends beyond the tangible as it connects meaningfully narratives about history, culture, and identity. [7]. This means that intangible cultural heritage is tightly coupled with tangible places as it encompasses the dynamic character which can help promote the social and functional diversity that exists in the historic fabric [8,9]. Deciding on the values associated with the historic fabric, so what is important to preserve, needs to involve the community, as they are best placed to understand what is important [9] (see also [9] for a process for determining the significance of historic fabric). It should be noted that the terms "cultural" and "culture" refer in the context of this work to all aspects of culture, being not only the arts, sciences and languages but also all the traditions leading to different lifestyles [10]. The main reason that culture is better classified as intangible is that it cannot be linked to its tangible products, as it is continuously living and evolving [11]. Heritage can best be described as a property that is or may be inherited. This means that time is also an important factor to include when thinking about intangible cultural heritage. ICH is fluid, different, and is never performed identically [12].

## 3. The importance of preserving ICH

Tangible objects, such as buildings and monuments, can be documented and preserved with much more ease than stories and memories, primarily due to their intrinsic physicality. Intangible heritage, on the other hand, lacks this luxury, and is thus more challenging to record, conserve and safeguard [13]. Intangible heritage carries within itself the types of practices and traditions that gave value, meaning and configuration to the associated tangible places. If there is no way to protect this intangible heritage, it risks, for the great part, to go extinguished. Observing the order of investments reserved to the cultural preservation by the International Cultural Organisations, the prevalent trend has been to put, above all, the safekeeping of the tangible objects. Objects that are coupled explicitly with the humanity’s visible heritage. Despite the efforts, the world’s intangible heritage has received insufficient attention, and the dangers of failing to catalog such knowledge, are so far, of underestimated consequences [14]. Missing at documenting considerable portions of ICH would mean failing at documenting the mainspring of humanity’s cultural diversity [15]. UNESCO considers the safeguarding of cultural diversity, consisting of both tangible and intangible heritage, one of its major tasks, as: *‘cultural diversity is what makes our world rich and vital’ [14].*

One of the fundamental threats to the sustainability of ICH, perceived by the communities, is largely singled out to be the processes of globalization and development [16]. These advancements have been discussed to significantly threaten cultural heritage resources, not only from a physical point of view, but also in terms of transforming the socio-economic dynamics, and consequently intangible

78 features of the cultural landscape [17]. Globalization and development are hardly avoidable and are  
79 regarded by the collective wisdom as the most prominent attacks against the protection of traditional  
80 expressions and local cultures [18]. Documenting ICH in the 21st century is a pursuit often challenged  
81 by the expansion of the intermingling of cultures, a trend substantially attributed to the effects of  
82 globalisation. More so, technology has had a fair share of criticism when looking at the way traditions  
83 and oral culture are propagated across generations. With the prospect of the human race, moving  
84 towards an even more changeable and uncertain future, collecting the intangible products of these  
85 checkpoints in time becomes a pivotal facet of the history of humanity [15]. In spite of globalization  
86 and development, political shifts and policy decision-making entities have proven to impact cultures,  
87 making the forward march of progress not the only factor at play. Authoritarian governments, for  
88 instance, at different levels and degrees of influence, have been pointed at as determinant factors  
89 in either the conservation or the shunning of ICH [16]. Present-day is a time where the loss of this  
90 diversity and cultural identity plays a crucial role, as well as a time where intangible cultural heritage  
91 is threatened by the dispersal of communities, making its protection critical [19]. The safeguarding of  
92 these cultures including all of their practices, knowledge, skills, artistic expressions, craftsmanship,  
93 dance and performance arts responds to the need of strengthening cultural diversity [19].

94 Another reason why preserving ICH is important [1] is that it is expected to stimulate international  
95 solidarity and cooperation towards the safeguarding of cultural differences and identities [20]. In order  
96 for the actions stated above to exhibit, the element of awareness needs to be encouraged towards the  
97 recognition of the cultural values of the people involved in the process of cultural holding. One of the  
98 first steps that can be taken for achieving greater cultural awareness, is to reach out to the families as  
99 well as the educational institutions which play the roles of knowledge buffers between the individual  
100 and the society [21]. An application that can help capturing the ICH of a place, could swiftly bridge  
101 the gaps between those cultures at risk of extinction and the appropriate cultural institutions, whilst  
102 placing the user at the center of the preservation process.

103 So, safeguarding intangible cultural heritage is extremely important. ICH strongly connects with  
104 cultural diversity, susceptible to technological developments and globalization. We suggest to initiate  
105 this process by starting from an understanding of the difficulties faced when documenting ICH, and  
106 instigating the necessary awareness regarding this problem. An application that captures ICH can  
107 create a safe zone from where the act of understanding cultural diversity and the growth of personal  
108 sensitivity towards the heterogeneity of ICH can together develop into practices that are widely taken  
109 up and encouraged.

#### 110 4. Existing ways of safeguarding ICH

111 Before even considering ways to safeguard ICH, it is important to mention that in the majority of  
112 countries around the globe, it is impossible to protect communities' property rights as there are no  
113 legal provisions, and that communities may be unaware of their heritage's potential value to others  
114 [22]. There have been attempts to protect and preserve the world's cultural heritage in the past. Japan,  
115 for instance, through the endorsement of the Law for the Protection of Cultural Properties [23], has  
116 listed a set of both tangible and intangible properties, including humans, as living treasures. All of  
117 this with the aim to preserve the Japanese ICH. The consequences of a failure to comply with this law  
118 have been treated by the government at the same level of importance as any malicious attacks carried  
119 against the very survival of Japanese civilization. Other countries such as South Korea, the Philippines,  
120 France, and Romania have all set up similar programs in response to similar concerns [24].

121 Other deliberate efforts towards the protection and preservation of ICH were discussed in  
122 meetings held in the 1980s by UNESCO (such as setting up educational programmes, special science  
123 funding for the preservation of folklore, dedicated (sections in) museums), however, very few countries  
124 have used these since [24].

125 The International Convention for the Safeguarding of the Intangible Cultural Heritage [25] has  
126 been the first intercontinental attempt to standardize the conservation of ICH with a digital plan of

127 action. The primary objective being to urge nations to develop a digital inventory consisting of all  
128 intangible information related to culture, with the underlying contributions of groups and communities.  
129 [20]. Despite most nations efforts to abide with the call, the challenge of documenting and preserving  
130 ICH remains an open issue [24]. The concept of crowdsourcing in the digital area can soon become  
131 the imperative source for collecting and managing ICH databases, especially with the convenience of  
132 all-in one mobile applications [6].

133 As a result, more and more nations are investigating ways to digitize their collections [24] to make  
134 them accessible to the public. In India, for instance, the governmental announcement to carry out  
135 comprehensive documentation of all of its national intangible heritage ensures that every expression  
136 of heritage will get a spot in the preservation. The Indian government wants to accomplish this by  
137 making extensive digital inventories to store ICH data for the future [26]. An application relying upon  
138 user-generated content could help to digitize and catalog ICH data for wide access and usage, more  
139 conveniently than analogical means.

140 ICH can also be considered Intellectual Property. This domain-shift sees ICH turning into the  
141 subject of an individualistic approach, identifying individuals as the creators and guarantors of the  
142 intangible. Treating ICH as Intellectual Property opens ways to attribute its content to copyrights,  
143 patents, trademarks, etc., thus protecting the holders and the data. Looking at the entirety of the  
144 information ecosystem, heritage protection has mostly been done using similar approaches [26].  
145 Nevertheless, the limits are still present [27]. Firstly, it is hard to identify a single creator of ICH  
146 that is passed down generations whilst being shared within the community. Secondly, ICH outlives  
147 its creators, questioning the concept of ownership. Thirdly, transforming non-material heritage to  
148 tangible could potentially inhibit permutations of the same [19]. This approach also risks privatizing  
149 something that belongs to a community instead of a specific person [26]. The restrictions coming from  
150 the individualistic attribution of ICH are extended, leading to ICH as a community-based approach.

151 Communities have proven to be vital in enriching cultural diversity [1]. This approach considers  
152 intangible cultural heritage more as a knowledge commons, meaning it is a resource that is shared by  
153 a group of people comprising communities. Inventorying heritage to its holders plays a big role in  
154 safeguarding community ICH, as long as policies are put in place for the prevention and deprecation  
155 of any discriminatory misconduct [19].

156 Safeguard and transmission complete the backbone structure of a sustainable ICH framework.  
157 Transmission can be in the form of teaching or training. Teaching allows for acquiring the most  
158 important skills and knowledge related to a specific intangible heritage, but does not cover the tacit  
159 knowledge. In other cases, intangible knowledge cannot even be taught at all. To overcome these  
160 problems, projects should be developed to answer educational needs and make it possible to transfer  
161 the knowledge commons to future generations [19]. Capturing and protecting intangible cultural  
162 heritage by using a mobile application makes it possible to store and transfer ICH to future generations.

163 As a concluding remark it should be mentioned that even though technology has the potential to  
164 significantly help the preservation of ICH it cannot alleviate most issues surrounding the preservation  
165 of ICH without favorable regulatory systems reflecting local conditions and including legislative  
166 and regulatory measures aimed at the conservation and management of the intangible attributes of  
167 intangible heritage, including its social, environmental, and cultural values.

168

## 169 5. General Principles

170 Within the bounds of the complexity and fragility of ICH, there are essential questions that need to  
171 be addressed. For a start, there is a need to discuss what it means to preserve ICH (Does it mean  
172 recording ICH or keeping traditions alive?), what regulations are needed around the process of ICH  
173 data collection (Can anyone provide ICH knowledge without any sort of verification?), acquisition  
174 (What data is permissible to collect?), handling and storage (What happens to the data once is collected?)

175 Who can access it and make changes? How do we prevent misuse?). Additionally, there is a need for  
176 ICH data standardisation and the call for a legal framework in the attempt to preserve and validate it,  
177 as well as the rights of the people and communities whose ICH is being recorded. Here we address  
178 some of these questions in the form of general principles.

### 179 **What it means to preserve ICH**

180 As stated by Bonn *et al.* [28]: *One of the fundamental truths recognized by the living history centers is that*  
181 *much of what we regard as intangible cultural heritage takes the form of embodied practice, and that preservation*  
182 *of heritage requires sustained and repeated enactment of that practice as part of the means by which it is*  
183 *preserved over time.* Preserving ICH means maintaining cultural diversity, promoting the understanding  
184 of differences and facilitating intercultural dialogue. ICH is not simply a cultural manifestation,  
185 but a great wealth of knowledge that is **community-based, representative, inclusive, traditional,**  
186 **contemporary and living at the same time** [24]. The conservation of ICH can take different forms,  
187 based on whether the scope is to preserve it at a certain state, to re-discover it after periods of neglect  
188 or keep it alive in the community or through practices and costumes. The choice of what can and  
189 cannot be recorded and/or maintained as a living tradition is up to the users and the community due  
190 to moral and ethical considerations and the breadth of ICH. Some ICH is better only recorded, as old  
191 traditions may no longer be ethical or viable, whilst for other ICH continued practice (which may  
192 include evolution) is important. For example, the Sinterklaas tradition in the Netherlands is part of  
193 its ICH, but due to racism concerns the use of Black Peter is currently evolving into a more acceptable  
194 form.

### 195 **ICH privacy issues for individuals and the community**

196 The privacy concerns arising from data-collecting electronic devices have been analysed in previous  
197 research [29–32]. Several international regulations have already been put in place, attempting to solve  
198 the digital world's privacy problems, such as the European GDPR regulation that are directly relevant  
199 to privacy issues for ICH [33]. The impact of regulations for the reinforcement of privacy of Intellectual  
200 property in the context of ICH has been subject of prior studies [34]. The topic of privacy and security  
201 is critical to the engineering of any framework designed in the digital age and which, by itself, deserves  
202 a designated part of the theoretical groundwork. More related work on this topic for ICH can be found  
203 in [19,35–38].

### 204 **ICH content validity and data integrity**

205 Data handling can be regulated through either Institutional interventions [39], Wiki Verifiability  
206 measures [40], framework-dependent quality assurance sourcing policies [41], dual domain  
207 watermarking [42], cataloguing templates [43] etc. The choice of data validity methodologies for  
208 the prevention of the 'trivialisation' or 'dumbing down' of the data for ICH collection will depend  
209 on the objectives and the scopes of the ICH platform. A commercial mobile application will have to  
210 comply with the international regulations concerning data handling. Further preventive methods  
211 for reinforcing and preserving data integrity will be an essential part of the engineering of the ICH  
212 software, in respect to the content validity and the sustainability of the system.

### 213 **Content and Images rights - the question of ownership**

214 Whether the ICH is gathered collectively or via individual contributions, the question of ownership  
215 touches all aspects of ICH. A neat differentiation between the notion of "culture" and the one of  
216 'heritage' is presented by the work of Xiao *et al.* [44], where culture is local and heritage is publicly  
217 owned. This differentiation might be at times too generic to fit all of the content ownership-attribution  
218 scenarios. Given that the existing legal arrangements concerning heritage remain under the control  
219 and power of the Nations, there is still a lot that can be done to give credit to the distinct Indigenous  
220 nations that own, enact and assert these heritages in specific cultural terms [45]. The same applies  
221 to individuals or small groups of individuals. The question whether labels such as "authenticity",  
222 "preservation" and "ownership" should be even applied to the ICH domain is still open. The work by

223 Lixinski offers a critical interpretation of the notion of "ownership" since it argues that there is no such  
224 thing as "authentic" intangible heritage, and that to think of intangible heritage in these terms could  
225 lead to a dangerous commodification of what should be manifestations of living, constantly-evolving  
226 cultures [46]. The debate is indeed still open, and the direction that will be taken by the policy-makers  
227 will determine the future of ICH as a commodity limited by its territorial idiosyncrasy, or better, as  
228 common heritage of mankind for the enhancement of cross-cultural dialogue.

### 229 **The pros and cons about the Digital Recording of ICH**

230 Converting the 'invisible' to 'visible' with a highly dynamic degree and the full-sensory experience  
231 is just one of the known challenges for the digitisation of ICH [47]. With the democratization of the  
232 ICH sourcing there is also the growing risk associated with the lowering of standards. A number of  
233 strategies have been documented to face these risks: a) To note the difference between documentary  
234 and video archives; b) To focus on the selection of digital objects, without blind digitization; c) To  
235 protect the inheritors' rights and data security; d) To carefully select the digital preservation format  
236 and medium; e) To strengthen the combination with related knowledge and technologies. More about  
237 these can be found in the work of Yang [47].

### 238 **Ethical and Moral principles of ICH**

239 The first point closely regards one of the main criticisms that have affected ethnographic and  
240 anthropology since the beginning of the concept 'going native' under the point of view of the  
241 professional researcher [48]. With the additional introduction of the crowd as source of knowledge,  
242 the ethical and epistemological risks associated with the observers not being external and distant  
243 in relation to the action recorded is even more so prevalent. The case for the data-providing users  
244 that should or should not partake in the unfolding of the ICH can be subject to discussion when  
245 designing the application. Another issue is if and how a clear distinction between the observer and  
246 the observable should even be considered. The other main problem originating from the recording of  
247 ICH is the requirement of human consent to do so. Ideally, all people documented through a mobile  
248 application should be protected at the highest ethical standards with ethical approval forms, however,  
249 when recording a big cultural event this may not be possible. In any ICH capture, participants' rights  
250 would ideally apply, including the right to be informed about the capture, the right to fully decide  
251 whether to participate in the capture, and the right to withdraw at any time without penalty [49].

### 252 **Data handling and storage - transparency and purpose**

253 While most people are broadly aware that companies collect data on them, they are surprisingly  
254 unformed about the specific types of data they give up when they go online [50]. An ICH application  
255 that teaches its users about data transparency and handling, allows them to have full control over  
256 what is stored and the clear ways that this information is administered and collected would comply  
257 with the design recommendations we have herein explained. Users' trust should be at the center of the  
258 application design, as voluntarily identifying and adopting the most stringent data privacy policies  
259 can, in the long run, not only gain the trust of the users, but also prevent misuses and irregularities.

## 260 **6. Mobile apps for capturing ICH**

261 While many projects exist that try to capture and preserve ICH, not a lot of them try to do this using  
262 mobile technologies. Building a platform/system to capture ICH conveniently offers a virtually  
263 unlimited access to content resources. However, an examination of the projects made it clear that most  
264 solely focus on documentation [51]. Almost all of the projects that actually make use of an app, use  
265 the same technology and methods to some extent. Most of the time the user's location, interests and  
266 previous choices are used to present intangible cultural information about tangible places and to give  
267 suggestions on where to go next. The presentation of this information is mostly done using Augmented  
268 Reality. This does not necessarily mean that every app uses the smartphone camera to point in a  
269 certain direction, and overlap that view with layers of visual information to mix it with reality [52],

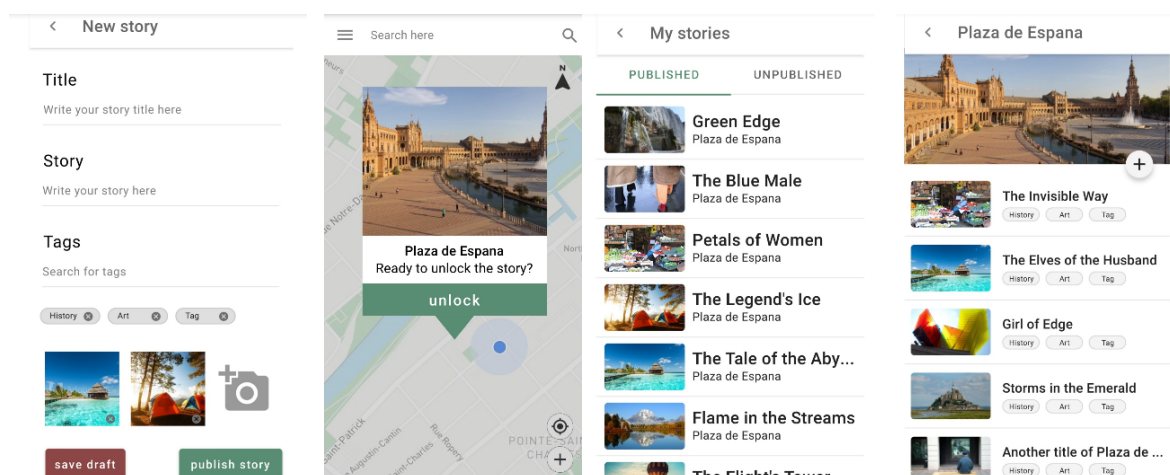


270 but also that geographical positioning data, video and/or sound can be used to transfer information.  
271 By taking advantage of Augmented Reality, the user's experience can be enriched by giving him or her  
272 a more complete understanding about the cultural content of a specific location or place [53]. There  
273 are many developments in the Augmented Reality area with regards to cultural heritage, as mobile  
274 app designers are using it to offer experiences that are unique for every user in natural environments  
275 [54]. By providing these experiences, they hope that their digital applications will promote more  
276 understanding and knowledge about heritage, whilst also creating value and appreciation for it [54].

277 A good example is a mobile application made for Castello, a neighborhood in Cagliari, Italy.  
278 The goal of the app is to guide tourists around the neighborhood, tell them which cultural heritage  
279 sites are worth visiting and if there is enough time to do so. This is done using a simple query based  
280 on the user's demographics, such as age and physical ability. The app presents the user a list of  
281 site recommendations to visit according to thematic and geographic proximity [55]. These lists are  
282 connected to multiple "points of interest" (POIs) and "smart walks". These smart walks are routes to a  
283 given place with several things to see on the way there. The app calculates the time to get there and  
284 also places the POI on a 'smart walk', or route, with more POIs. Once a user has arrived at a POI, the  
285 app presents information, guidance, and info obtained about it [52]. The user walks from a start point  
286 to a finish point, with several POIs on the way. This also allows for the intangible cultural heritage  
287 that is linked to the place to be disseminated [55]. After a visit, the user can rate each visited POI in  
288 terms of the quality of service offered. Users can also comment, tag, upload images, add folksonomies  
289 (certain taxonomies about a physical place used by the community) and new knowledge about the POI,  
290 which might be a landmark [55]. This way every time a POI is visited, more intangible information  
291 about it will become available for the next visitor. Another user can decide to take this or another route  
292 based on this information. All of this feedback can then be shared on social media, thus reaching more  
293 potential visitors. This system can be used by moderators and people that just use the app to find  
294 out more about the city. The moderators can improve the application by using feedback from general  
295 users and these users can, in turn, enrich the information originally posted by the moderators [52].  
296 This method ensures the broad participation and sharing of information between all actors and creates  
297 a balance between material cultural heritage and local wisdom [56].

298 There are several similar apps as the aforementioned, which add salient features for developing  
299 a sustainable platform to capture ICH. For example, members of a local community can also be  
300 motivated to use such apps to upload data with authentic intangible cultural heritage information and  
301 pass it on to younger generations and people around the world [57].

302 In another app [53], the designers put the focus on sound. More specifically, the app leverages  
303 'Storytelling' to transform the mobile device into a virtual narrator that tells stories and anecdotes  
304 about a place that can enrich the visit, or simply provide the user with historical and social information  
305 [58]. This narration can be done using material stored in sound archives tied to a particular location,  
306 creating a guided tour based on a GPS location and the points with audio content attached to them.  
307 The material can be roughly subdivided into two categories: narratives and excerpts. Narratives  
308 are recordings of inhabitants telling their own stories, memories, anecdotes, and oddities they know  
309 related to the place that would be forgotten were it not recorded. Excerpts includes poetry, theatre,  
310 songs, folk tales and popular knowledge belonging to the tangible heritage. As the position of the user  
311 alongside the route is constantly logged, users can also create audio files themselves for other people  
312 walking that same route to hear later on. In other words, using an audio guide telling authentic stories  
313 and information originally recorded in the same area about tangible heritage allows tourists to have  
314 access to intangible heritage and look up to the sites, monuments and buildings, without forcing them  
315 to look at the screen of their devices [53]. Authorities are increasingly interested in mobile applications  
316 that track how people use the city, such as the application used by Florence to track tourist flows [59],  
317 and such applications could be expanded to allow the capturing and passing on of ICH.



**Figure 1.** The four paramount features of the StoryBee application design in order: imaging, geo-referencing, contextualization and sharing.

## 318 7. Towards capturing ICH through location-based crowdsourcing

319 As all data gathering and capturing is actively done by users, our crowd-sourced data falls into the  
 320 category of non-framework active crowd-sourced geographic information. The following provides a  
 321 short summary of the tasks one can use in such an app:

- 322 • **Imaging** can be used to ask users to take and capture images of specific POIs.
- 323 • **Geo-referencing** can be used to link these images to coordinates on the map that will be used in  
 324 the application. The app will do this automatically, or the user can do it manually if he or she  
 325 thinks the coordinates that the app calculated are not accurate enough.
- 326 • **Contextualization** can be used to attribute information to these POIs. This information can  
 327 include users' stories, memories, folk tales, traditional songs, thoughts, and more. These can be  
 328 uploaded using text or audio.
- 329 • **Validation** can be used to assess the quality of the contributions. Users can do this by voting on  
 330 other people's contributions and moderators can check these assessments.
- 331 • **Sharing** can be used to share contributions and other information in the app with other people.  
 332 This way people get invited to also use the app and this may attract more users.

## 333 8. Assessing the Quality of Crowd-sourced Geo-spatial Data

334 The quality of information is one of the crucial points for whether the city application should adopt  
 335 crowdsourcing and other related methods. Numerous traditional quality factors have been designed  
 336 to determine whether a piece of data is of sufficient quality to use. These factors include accuracy,  
 337 lineage, completeness, consistency, temporality, reliability, robustness, truthfulness and credibility [60].  
 338 To shortly present each:

- 339 • **Lineage refers to knowing who uploaded what.** This could be solved by implementing a system  
 340 where users need to create an account with information about them, such as characteristics and  
 341 interests. This way you always know who contributed what and at the same time the account  
 342 can be used for other functionalities.
- 343 • **Attribute accuracy refers to the terminology and classification being used.** The app could  
 344 provide the user with templates he or she needs to fill out when creating a Point of Interest (POI).
- 345 • **Completeness means that every POI should have an adequate amount of information.** This  
 346 could also be improved by using templates.
- 347 • **Logical consistency means that the contributions need to be checked for validity and quality.**  
 348 Moderators can check this information themselves in the portal or users can up-vote and

349 down-vote regarding the quality of a POI. When the quality is not sufficient enough, the app  
350 could provide the users with tasks to improve the quality of the information of certain POIs.

- 351 • **Temporal quality refers to how up-to-date the contributions are.** By giving the contributions a  
352 time-stamp, moderators or active users can update the information about some POIs when they  
353 think it is outdated.

354 Non-traditional quality factors include:

- 355 • **Malicious or mischievous content** can be reduced by using user profiles and regular check-ups  
356 of POIs by moderators, as well as a voting system.
- 357 • **Specification with User Participation and Documenting.** The data quality of Geo-spatial  
358 Metadata is concerned with the quality of attributes, which can be achieved by using templates  
359 for users to fill in. However, there should be a balance between the amount of information that is  
360 mandatory to fill in and the amount of freedom the user is provided with.
- 361 • **Linus's Law** says that the more people review a problem, the better the solution will be. We  
362 suggest that the app has to give the user the option to review the POIs in their neighborhood. This  
363 is the area they know the best and will most likely result in the highest quality of information.
- 364 • **Hierarchical Structures** for Quality Assurance refers to using moderators and other hierarchical  
365 structures. We suggest that the app should use moderators, a reputation system and ranks. This  
366 will be covered in the Gamification section.

## 367 9. Motivators

368 Crowd-sourced geo-spatial data has two central parts, i.e. the crowd-sourcers and the geo-spatial  
369 data. Much of what is discussed up until now has explained what crowdsourcing exactly is and how  
370 the quality of geo-spatial data can be assessed. Yet, maybe the most important part is to look at how  
371 people can be attracted to contribute to the app using incentives, understand their motivations for  
372 contributing and respond to that, and how to retain these contributors. To help understand what the  
373 motivations for participating are and how they are different for the contributors, it is important to first  
374 find out which types of people participate in crowdsourcing geo-spatial data [61]. Crowd-sourcers can  
375 be categorized as follows [62]:

- 376 1. **Map lovers and experts** who are happy to provide accurate information in cases when maps are  
377 wrong or are missing information. These could be retired professional mappers; when they see  
378 something wrong on a map, they might be willing to let the authorities know.
- 379 2. **Casual mappers** who can be part of a biking/hiking community and map whilst doing those  
380 activities. Casual mappers are most of the time only willing to spend a relatively low effort for  
381 mapping and would rather upload new data than looking for errors.
- 382 3. **Media mappers** who respond to specific campaigns such as mapping parties and post-disaster  
383 events.
- 384 4. **Passive mappers** who automatically provide information via their mobile phones often without  
385 even knowing it. This regards information such as where traffic jams occur.
- 386 5. **Open mappers** who actively contribute to platforms such as OSM. This is by far the largest  
387 group, and their number is constantly growing. They are motivated by contributing and using  
388 good public data.
- 389 6. **Paid mappers** who are driven by getting paid for doing an activity, e.g. Mechanical Turk from  
390 Amazon (a platform that pays users a small amount of money for small tasks).

391 These categories already provide some insight into the different types of interest in the subject  
392 (map lovers, experts, open mappers) or material gain. Although it could be said that a lot of motivation  
393 is thought to be altruistic, the range of motivations is much more complex and nuanced [61,62]. Not  
394 all of these categories are relevant for the city application, as it attracts other users in comparison with  
395 other crowdsourcing applications. Categories that are probably less relevant are casual mappers and

396 passive mappers. The casual mappers do not necessarily apply to the city application because those  
397 people mix mapping with other activities, and as we are capturing intangible cultural heritage, this  
398 does not mix well with mountain biking or rock climbing. The passive mappers are not relevant to  
399 the city application simply because they don't provide intangible cultural heritage data. The other  
400 categories are all quite interesting and relevant for our case. Map lovers and experts can be people that  
401 know a lot about Utrecht or even their local neighborhood and want that information to be correct. It  
402 could also be someone that has worked at a place of interest for a long time and wants the application  
403 to display correct information about it.

404 Media mappers will probably become active after the city application has been promoted  
405 somewhere and they hear about it. Open mappers will hopefully be the biggest group and will  
406 consist of people that actually think the idea of the project is interesting and want to contribute to it.  
407 Mappers that are motivated by financial incentives can be used when the city application will make  
408 use of money to let people perform tasks.

## 409 **10. Motivational factors specific to Geo-crowdsourcing**

410 Geo-crowdsourcing (GeoCS) has demonstrated itself to be a potential problem-solving tool for public  
411 management [63]. Budhathoki and Haythornthwaite [64] provided a comprehensive list of different  
412 motivational factors that they found in the literature regarding domains for motivation: volunteerism;  
413 leisure; and the generation of knowledge online (see Table 1). These factors can also be assigned to  
414 two different categories: (1) intrinsic motivation, which comes from from the individual itself, and  
415 (2) extrinsic motivation, which is influenced by the outside. Both are very important as they are both  
416 positively associated with user participation [65]. For extrinsic motivation, one can think of gaining a  
417 positive reputation on the platform after a successful contribution or receiving a financial reward for  
418 contributing. Because this list is the most comprehensive one we found, these factors can provide a  
419 basis for investigating which motivations the participants of the city application can have.

420 Using these factors, Budhathoki and Haythornthwaite [64], conducted a survey to try and  
421 understand which of these motivational factors were relevant for OSM volunteers. For the survey, they  
422 divided 444 OSM volunteers into two groups: serious mappers and casual mappers, based on how  
423 much and how often they contributed, and how long they had been contributing. From the survey, they  
424 found the most important motivational factors. For both groups, two extrinsic factors, i.e. community  
425 and project goal, and two intrinsic factors, altruism, and unique ethos were the most essential factors.  
426 Other important factors included: fun, trust in the system, the freedom to provide the information  
427 wherever they wanted and local knowledge (instrumentality and self-efficacy). Both groups also had  
428 some distinct results. Unique ethos was ranked higher by casual mappers, and learning by serious  
429 mappers. Understanding these motivational factors is important for providing strategies to turn casual  
430 mappers into serious ones, as serious mappers are more valuable for a participatory platform. Boosting  
431 the casual mapper's confidence and emphasizing the importance of local knowledge are two examples  
432 of strategies to turn casual mappers into serious ones.

433 Previous studies [66] have found that the most important factors for OSM and GISCorps  
434 volunteers were altruism, personal satisfaction, gaining new geo-spatial knowledge, strengthening of  
435 social relationships and fun. Volunteers were also questioned on which kind of incentives they thought  
436 would help increase their participation. Many volunteers were interested in additional geo-spatial  
437 training. Something that could be used to train volunteers is to use and provide templates, as this is  
438 described to be a motivational factor [62]. Using templates, volunteers can learn and train by filling in  
439 the templates until they do not need the templates anymore. Composto *et al.* [67] found that volunteers  
440 wanted something back as an incentive for future contributions, such as feedback. When a project or  
441 application gives their users feedback regarding their contributions, it may make their users believe  
442 that their efforts are recognized and valued. This will prompt users to reciprocate by more actively  
443 participating in crowdsourcing tasks and may make them feel indebted to the crowdsourcing project

**Table 1.** Motivational factors for Crowd-sourced Geo-spatial Data, content adopted from [64].

Type	Factor	Relation to CDG
Intrinsic	Unique ethos	People think that maps should be openly available and free for everyone who wants to use it
	Learning	Using the application, people gain new knowledge about mapping, the technologies being used and places
	Personal enrichment	People find satisfaction in contributing to the project
	Self-actualization	People appreciate their talents, knowledge about local areas and skills in mapping more after they have contributed something good.
	Self-expression	It enables people to express their knowledge of local areas and mapping
	Self-image	It gives people the opportunity to gain more confidence in themselves through contributing
	Fun	People enjoy the process of contributing and actually seeing their contribution getting used online
	Recreation	Mapping outdoors is a form of recreation that people can enjoy
	Instrumentality	It gives people the opportunity to correct wrong or incomplete information on a map.
	Self-efficacy	People feel effective because they contribute to the project
	Meeting own needs	The ability to fill in missing information that is needed for other applications
	Freedom of expression	Ability to provide whatever information people want and when they want.
	Altruism	Contribute to a project because it is a social cause.
Extrinsic	Career	Contributing to a project can actually be mentioned on people's CVs and can develop skills that can be used on the market for other jobs and opportunities
	Strengthening social relations	Creating social bonds with other participants through mapping parties and other get-together
	Project goal	The goal of the project corresponds to the goals of the contributor
	Community	Feeling you belong to an interactive community
	Identity	Becoming part of (another) (sub)-group, e.g. promoting to a group with a higher level of expertise in mapping and knowledge
	Reputation	Getting recognized for your efforts by the system or community
	Monetary Return	Making money by involving yourself in the project
	Reciprocity	The idea that if you contribute, others will do the same
	System Trust	If the system is trustworthy, it is worth to contribute to
	Networking	Contributing can form networks with people in the community, or other people that are related to the project, both locally and internationally
	Socio-political	Contributing is in line with people's socio-political motivations

444 resulting in even more participation [68]. Research has shown that crowdsourcing initiatives with  
445 more visible feedback had longer and more sustained participation [69].

## 446 11. Recommendations for a future-proof ICH app: The case of StoryBee

447 Based on the literature, we developed recommendations for our ICH app StoryBee, which captures  
448 ICH in cities through crowdsourcing. StoryBee is an Android application developed in the context of  
449 Utrecht University's Research IT innovation programme, project "Collaborative crowdsourcing tools  
450 for sustaining intangible urban heritage". The alpha version of the app was completed in January 2020  
451 and is currently being tested. Below we describe the key design recommendations, which according to  
452 the literature are essential for the design of a successful mobile ICH application, and which drive the  
453 design of StoryBee.

### 454 11.1. Attracting and recruiting

455 User traction is fundamental in designing a successful mobile application; without this element at play,  
456 the application life-cycle is compromised. One way to outline and identify the target audience is to  
457 interact with some of the users of other existing applications. Gathering user experience surveys, for  
458 example, can help yielding valuable insights into the users interests, motivations and other salient  
459 usability factors. Only after the target audience is correctly pointed out that the promotion of the  
460 framework can be appropriately tailored. Looking into the different ways a cultural application can be  
461 sponsored, promotional events fall in the classical route for supporting the cause for attracting and  
462 recruiting users, whose personal interests are most likely aligned with the project's objectives.

463 Media campaigns can also be used to attract new users, despite their reputation for short term  
464 retention capabilities. Media campaigns can include advertisements, letting other users share their  
465 content on social media and getting featured on TV-shows or other platforms. Mapping parties are  
466 also worthy of notice as they are thought to enhance the community spirit and attract not only existing  
467 users but also new ones, combining education and entertainment into one single attractive event.  
468 Other marketing strategies include the emphasis towards the awareness factor and the promotion of  
469 the application amongst Universities, and in so doing, potentially triggering students in the process.  
470 Academic engagement would focus on the following: **project goal, system trust, personal interest,**  
471 **curiosity, community, networking, altruism, self-efficacy, instrumentality, meeting own needs and**  
472 **personal enrichment.**

### 473 11.2. Motivation and Retention

474 Attracting users is just one essential aspect when designing a mobile application reliant on its  
475 contributors for its development and maintenance. Usability plays a crucial role in assuring that  
476 the majority of the users are satisfied and stimulated when returning to the same application. Poor user  
477 interfaces can lead to a sharp growth in dissatisfaction and frustration, including unresponsiveness of  
478 the interfaces, poor choice of UI components, clashing colour schemes, lack of readability, poor user  
479 flow, etc. It is therefore important to list the main criteria to be followed when designing applications for  
480 better retention and attraction. Following a list of prescribed measures that we consider indispensable:

481 **Make it a side effect/implicit work.** When users are new to the app, they might not necessarily know  
482 the set of functionalities at hand. We recommend that the optimal way to introduce the users to the  
483 features and functionalities of the framework is to make the act of contributing to the content, a 'side  
484 effect' of the user experience. As the application gathers the GPS information of the user, this is capable  
485 of recognizing when and if a user is near a particular POI. It can also notify the user when in the  
486 proximity of POIs. The notification can include information about the POI and where it is exactly, and  
487 ask if the user wants to add extra information. This can range from taking a picture, adding a story or  
488 simply reviewing other people's contributions. The user can add content to the app without actively

489 going to a certain POI, thus lowering the effort to contribute. This functionality can be optional, so  
490 people have the chance to turn the notifications off.

491 **Use Proximity and Familiarity.** This is very important and useful because the app works with  
492 geo-spatial data. Everyone has a place or neighborhood they know a lot about because they were  
493 born there or have lived there for a long time. That is why they think they are an expert with regard  
494 to knowing things about those places. They also want the information about their neighborhood to  
495 be correct and don't want to see it go extinct. This may even make them feel obligated to add and  
496 review content about POI in their neighborhood. The app could ask the user to review POI in his  
497 neighborhood and add his own authentic stories and pictures to it. For this to work the user is asked  
498 to indicate which area they live in, was born in or knows a lot about. This is not mandatory of course.  
499 This is in line with Linus' Law, a quality factor discussed above. [60].

500 **Use user-tasks or missions.** Up until now, the term task has been used. We would actually suggest  
501 that the app uses the term mission, as this has a way less compelling and compulsory sound to it. It is  
502 also a term used in a lot of games, which is in line with the gamification mechanics that will be used.  
503 The best way to gather geo-spatial data is to actively ask users to perform missions that require them to  
504 gather and upload geo-spatial content in a fun way. We recommend having a wide variety of missions,  
505 so users don't get bored or feel like they can't do any of the missions provided. Different geo-spatial  
506 user tasks and types for data input. For instance, imaging can be achieved by taking a picture of a  
507 POI, contextualization is done by adding a story to a specific POI, sharing can be the interaction with  
508 other users, validating is achieved by doing a quality check by reviewing and voting on other people's  
509 contributions and geo-referencing is done automatically or manually when someone adds a new POI.  
510 These missions can be divided over different levels of expertise. When a user has a higher level, quality  
511 checks could be done more often for instance, because that user probably has more expertise than  
512 lower level users.

513 It is also important to see the progress of a mission. When the mission is to invite 5 friends to the  
514 app, it should have a visual display showing how many people the user has already invited and how  
515 many are left. The missions should be clear and small-scale, so users know exactly what to do and  
516 do not get bored that easily because it is a small mission. Too many users on one mission should be  
517 avoided, as this has a negative impact on participation.

518 **Use a user-profile.** As mentioned before, we recommend using a user-profile. Without a user-profile,  
519 it is not possible to implement a reputation system, use leader boards or even hand out rewards or  
520 points. A user profile is the foundation for all of these mechanics. User profiles can include all sorts  
521 of information, ranging from basic personal information to avatars, all of their contributions, their  
522 level/rank, reputation, badges and amount of points. The user should be free to decide what he wants  
523 to show other people, with a few things being mandatory, such as name and avatar. This also opens  
524 up the possibility to have friends on the platform, send each other messages and challenge each other.  
525 This positively influences the lineage and reduces the amount of malicious and mischievous content  
526 [60]. Making an account should be an option though.

527 If users want to use the app without an account, that should be possible. You only need an account  
528 if you want to participate in any of the activities that require you to have a user-profile, like uploading  
529 content, voting, leader-boards and adding friends.

530 **Use a point system.** Award points or in-game currency for completing missions. The number of points  
531 that can be earned should differ for each mission, based on how difficult it is and how much time it  
532 requires. More points can be earned when a user is the first one to visit a certain POI than when the  
533 user visits a popular POI. More points can also be earned when a user adds a new POI than when a  
534 user just contributes to an already existing POI. Points can be earned by just checking in at POI to  
535 increase the number of visits and potential new content.

536 These points can be spent on in-game content, like gear for the user's avatar and other features. It  
537 is important that points are present throughout the entire application, as this keeps reminding and  
538 motivating people.

539 **Use leader boards.** Because players can earn points and have a user profile, it is possible to implement  
540 one or multiple leader boards. Some users are motivated to rank highly on the leader boards and  
541 thus will perform missions to earn points. Leader boards should be short term and have different  
542 dimensions. This means that if you have performed two big missions you score higher than someone  
543 who has completed two small missions. The benefit of having short term leader boards is that it does  
544 not disincentivize users, because they have a new chance of ranking high every week. It is important  
545 that the application lets the user know how to rank highly on these leader boards. The top three  
546 players on these leader boards could win a reward, or have a chance of winning a bigger award after a  
547 longer period of time competing with all winners.

548 **Use competition.** Because the app uses points, leader boards, and reputation, there is automatically  
549 a competitive element to it. Implementing competitions that users can participate may increase the  
550 motivation of some users to participate in the project. Users could invite their friends or other people  
551 to a friendly game, which could give them rewards/awards when they win. This competition could be  
552 to add as much content as possible in a certain neighborhood in a given time-frame. However, whilst  
553 competition should be available, it should also be easy to ignore for those users who are not motivated  
554 by competition.

555 **Use a reputation system.** As mentioned before, using a reputation system has a lot of benefits and  
556 uses. People can up-vote and down-vote other users, and based on those votes get points for their  
557 reputation. Being able to vote also makes sure that the quality of contributions is good enough (logical  
558 consistency) and it decreases the amount of malicious or mischievous content [60]. Having a better  
559 reputation, may mean more influence on new features, more privileges, and even a chance to become  
560 a moderator. Having a low reputation may mean restrictions on certain features, such as being unable  
561 to vote on and review the quality of other contributions. The app should not disclose every negative  
562 ranking or reputation from the user, as this can discourage them to keep using the app. Having a good  
563 reputation can result in being recognized in the community and thus will boost the user's confidence.  
564 The only way to achieve this is to actively do a lot of missions and have high-quality contributions.  
565 This positively influences retention and the quality factor Hierarchical Structures for Quality Assurance  
566 [60].

567 **Use rewards.** This mechanic has also been mentioned before. Rewards can be monetary or  
568 non-monetary. Non-monetary rewards can be in-game content, gear, currency or a big amount  
569 of points. Rewards can be earned by winning a competition, ranking high on a leader board or  
570 performing unique missions. We suggest that players should not be over-awarded as this might  
571 encourage active players to contribute too much and dominate, and thus disincentivizing others from  
572 contributing. When monetary rewards are being used, it is important to combine it with other intrinsic  
573 motivational factors, as the monetary reward will otherwise be the dominant factor for contributing.  
574 This can ultimately lead to users not wanting to contribute anymore without having the chance to earn  
575 money.

576 **Use badges.** Badges are a type of non-monetary status reward, which people get for achieving  
577 something unique. In this case, that could be completing unique missions that require particular skills  
578 or much time. People can show badges off on their user profile. This is also a sign of expertise and  
579 results in a better reputation. Badges should not be confused with points, as badges are achieved by  
580 completing unique missions and are visualized inside the app.



581 **Use feedback.** This includes both direct and indirect feedback. Composto *et al.* [67] found out that  
582 volunteers wanted to receive direct feedback from the platform they are using as an incentive for future  
583 contributions. When an application or platform gives their users feedback on their contributions, it  
584 gives them the feeling they are actually doing something and their efforts are recognized and valued.  
585 This will prompt the user to participate more in the future. Ways to do this is to have a good visual  
586 display of their POI. So, when a user adds something, they and other users can see the contribution  
587 right away. We also suggest that the application should highlight a different contribution every day or  
588 week on the main page of the app, so everyone can see that contribution. Another way to do this is to  
589 have a blog, forum or mail where the newest and best contributions are showcased every week. These  
590 emails can also be used to frequently communicate with the users, like talking about new updates or  
591 news, which is also good feedback.

592 Indirect feedback is when a user sees that the contributions of other users are being used and  
593 gets motivated by that. Research has shown that crowdsourcing projects that made use of a lot of  
594 visible feedback, had longer and more sustained participation [69]. Feedback can also go the other  
595 way around. Users should have the option to give the application feedback on what can be better or  
596 improved. It is crucial to know the needs of the users to satisfy them [70,71].

597 **Add a timeline to POIs.** We suggest that POIs should have a timeline linked to them, so the content  
598 that is added to that POI can be linked to a time in the history of that POI. When more people contribute  
599 to it and add a timestamp, it can be added to the timeline. 1001 Stories Denmark has implemented  
600 a screen for every POI at the same time [72], while we think doing this individually for the POI is a  
601 better idea. This increases the Temporal quality of the contributions [60].

602 **Use filters.** Because it could be possible to add (Facebook) friends on the application using the user  
603 profiles, filters can be used to our advantage. We could give the users the option to only display  
604 content that has been added by their friends, thus giving them a more authentic, reliable and trustful  
605 experience. The other way around also works. Users can decide to make their contributions only  
606 accessible and visible to only certain users (friends). Another filter that can be implemented is to filter  
607 on keywords (that other users need to fill in at the template). This way users can choose to only see  
608 certain buildings that are interesting to them.

609 **Use collaboration.** The fact that the app uses user-profiles and the option to add friends, opens up  
610 the possibility to collaborate. Friends could decide to explore a certain POI, smart walk or mission  
611 together. Doing things together is always perceived as more fun, so this would be a nice functionality.  
612 As is mentioned in the 'use competition' section, users could also challenge each other, like uploading  
613 a certain amount of information in a certain time frame.

## 614 12. Discussion

615 In general, all results that have been derived from the literature can be used for the application. The  
616 features make sure people have the chance to capture and gather their own intangible information and  
617 at the same time are motivated to use them. After analyzing the features, it is clear that most of the  
618 features try to reduce the effort people have to make to actually use the app and contribute content.  
619 Templates, smart walks, making it a side effect, and familiarity and proximity all reduce the amount  
620 of time, thoughts and effort the user has to make in order to add content or use the app. Also using  
621 gamification has been proven beneficial. On almost every screen of StoryBee some sort of game-element  
622 can be seen. Points, leader boards, reputation, and badges make sure the app is fun to use and thus  
623 prolonging the retention and continuation of users. Technologies of safeguarding ICH, crowdsourcing  
624 methods and system, motivational factors, incentives and methods have all been combined in order  
625 to derive a more certain Recommendation that can be used in the production of mobile applications.  
626 Especially the mock-ups can help with visualizing and can provide the development team with good

627 ideas of what a cultural application could look like, how the features could be implemented and how  
628 certain features could work.

629 Following the points mentioned in the 'General Principles' section, it is important to keep into  
630 consideration the four paradigms of ICH preservation: Safety, Quality, Efficacy and Multidisciplinarity,  
631 designed for ICH crowd-based applications. The decision to opt for a digital medium when preserving  
632 ICH can significantly help the expansion of participation and outreach to other countries, whilst  
633 increasing transparency. More so, the digitisation and popularisation of ICH through mobile technology  
634 can represent a novel shift of information flow. Going mobile would promote the continuous  
635 evolution and expansion of ICH, provided that regulators maintain a distinct role and take on a  
636 greater responsibility in ICH.

### 637 13. Conclusions

638 This research paper aimed to answer two main research questions:

- 639 • Which geo-located technological features can help us capture intangible cultural heritage?
- 640 • How can people be best motivated to use these features and contribute content?

641 All features listed in this paper can help to capture ICH, but motivating people to actually use  
642 them is another important part of this research. Based on the literature, it can be concluded that  
643 incorporating certain game-elements into the app results in the highest amount of contributions and  
644 user activity. crowdsourcing systems or applications that use gamification, have a bigger community,  
645 longer retention, and overall more contributions.

646 Using rewards like points, badges, or other compensations is one of the main motivators for people  
647 to use certain features, according to the literature. Getting points for adding intangible content, voting  
648 on other contributions, interacting with other users and participating in other activities throughout  
649 the app helps people to be motivated. Of course, earning points is not that interesting if the user has  
650 no way to spend them or show them off. That is why the application should work with customized  
651 avatars that people can spend their points on. Badges are earned by performing unique missions and  
652 can be shown off to friends or other users.

653 Another way to show off points and the amount of (good quality) contributions a user has added  
654 is to work with reputation. As concluded from the literature review, a lot of successful crowdsourcing  
655 sites use a form of reputation, as this increases user engagement and motivation. Feedback is one of  
656 the most important motivators for retention and making sure that users keep using an application.  
657 Based on the conducted research it can be concluded that almost every application and crowdsourcing  
658 system We have reviewed used feedback.

659 Showing users their own contributions on their user profile, showing them which POI they have  
660 visited in the past, highlighting a different contribution every day and allowing them to send messages  
661 to the team behind the app are all forms of feedback and are regarded as stimulating in regards to  
662 using the features.

663 Leaderboards is another example of feedback that is also linked to reputation. Having a  
664 few short-term leaderboards every week or month that show the users with the most amount of  
665 contributions or POI visited gives them exposure and appreciation. At the same time, this motivates  
666 other users to contribute more because they want to be in the top 3, especially when they can earn a  
667 reward by winning it. All of this interaction results in more user activity and ultimately leads to more  
668 contributions.

669 Finally, reflecting on the general principles discussed in Section 5 ("General Principles"), we  
670 note several challenges faced by current and future generations, namely challenges of (i) preserving  
671 mutating ICH, (ii) choosing the best representative medium for different forms of cultural expression,  
672 (iii) ethics and privacy, (iv) ethnocentrism, and (v) interpretability. This paper has covered quite an  
673 extensive part of ICH preservation, and we hope that the design requirements illustrated are taken  
674 into consideration as background work for future studies. Overall, in this paper by analyzing prior

675 work, we suggest routes for conceiving, designing and appraising a digital framework that uses  
 676 crowdsourcing as a way to capture the intangible cultural value of places and support the conservation  
 677 of the intangible experience, from a user and a community perspective.

678

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689 **Conflicts of Interest:** The authors declare no conflict of interest.

## 690 Abbreviations

691 The following abbreviations are used in this manuscript:

692	ICH	Intangible Cultural Heritage
693	CSICH	Convention for the Safeguarding of the Intangible Cultural Heritage
694	FGDC	Federal Geographic Data Committee
695	GI	Geographic Information
696	GPS	Global Positioning System
697	OSM	OpenStreetMap
698	POI	Point of interest
699	POIs	Points of interest
700	UGC	User Generated Content
701	UNESCO	United Nations Educational, Scientific and Cultural Organization
702	VGI	Volunteered Geographic Information
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