



**Public Participation Geographical Information Systems (PPGIS):
Literature review and proposed methodology for the pilot cases in the
North West of Ireland**

Working Paper 2

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Re-inventory-ing Heritage: Exploring the potential of public participation GIS to capture heritage values and dissonance (REINVENT)*

REINVENT is a two-year EU-funded research project which addresses the challenges pertaining to the management of cultural heritage in contested cross-border contexts in Europe, with a focus on the cross-border cultural landscape of Derry~Londonderry.

The project engages with participatory practices in cultural heritage management and the application of Geographical Information Systems (GIS) to mapping heritage on a cross-border basis on the island of Ireland. More specifically, a public participation GIS (PPGIS) methodology and tool will be developed to capture a plurality of heritage values ascribed by a range of communities at multiple spatial scales in the region.

It is argued that mediating between the competing uses of heritage is ultimately founded on identifying value conflicts and 'dissonance' to manage any contestation over time. Developing strategies to address these challenges in local contexts can greatly assist spatial planning and cultural heritage management policymakers/practitioners.

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ABBREVIATIONS AND ACRONYMS

DfC	Department for Communities
FOSS	Free and open source software
GCI	Getty Conservation Institute
HED	Historic Environment Division
ICOMOS	International Council on Monuments and Sites
NCGIA	National Center for Geographic Information and Analysis
NIRSA	National Institute for Regional and Spatial Analysis
PGIS	Participatory Geographical Information Systems
PPGIS	Public Participation Geographical Information Systems
REINVENT	Re-inventory-ing Heritage
MSCA	Marie Skłodowska-Curie Actions
VGI	Voluntary Geographic Information
WMF	World Monuments Fund

1.0 SUMMARY AND RECOMMENDATIONS

The purpose of Working Paper 2 (WP2) is to inform the development of a PPGIS-based methodology and associated mapping tool to capture the diverse range of heritage values ascribed by communities in the cross-border cultural landscape of Derry~Londonderry. The key research focal points of the REINVENT Project are elaborated to guide the literature review and informing subsequent decision-making over the methodology including a discussion of the proposed methodological learning, its embedding within local cultural heritage management networks, and application to innovative thinking on public participation within heritage inventorying processes.

Following an extensive review of the academic and other literature, the paper addresses several questions concerning Public Participation Geographical Information Systems (PPGIS), including its definition(s) and application to a diverse range of research subject-matters. Pertinent lessons deriving from the literature are subsequently discussed, with the narrative closely-related to critical issues such as heritage values, engaging diverse communities through the use of digital mapping tools, and the relevancy of PPGIS methods to research concerning conflict and contestation. The key research focal points of embedding knowledge of PPGIS within local policy networks in the North West and heritage inventorying processes are also explored through the literature.

A range of potential cases in the North West at three different spatial scales (landscape, area, building/monument) are then indicated in the paper in the context of certain identified aspirations and constraints. In relation to the latter, the constraints influencing the methodological choices include the timeframe for completion of the fieldwork stage of the research, the resources (financial and otherwise) available for this purpose, and the skills and capacity of the researcher to complete the diverse tasks. Furthermore, various PPGIS/digital mapping tools that are potentially applicable to the REINVENT Project are identified, with information conveyed on whether the software is available to download free and open source (FOSS) in addition to their adaptability to a range of PPGIS-type applications.

The paper recommends the use of the FOSS Arches heritage inventory and management software jointly developed by the Getty Conservation Institute (GCI) and World Monuments Fund (WMF), which is highly customisable and already in use by official heritage agencies including under trial by Historic England. Consequently, Arches has a credible track record in the heritage world, ensuring its relevancy to the island of Ireland where it has yet to be adopted, particularly as the upcoming version 4.0 will incorporate new and improved

capabilities such as facilitating mobile data collection, software installation and data management.

The paper recommends pursuit of the following three cases during the fieldwork stage of the REINVENT Project:

- North West Landscape Values Assessment – at the cross-border landscape scale, open to the general public through an internet mapping exercise focused on the identification of special place and landscape values
- Ebrington Sense of Place Values – at the area scale in (and in vicinity of) the former Ebrington Barracks regeneration area in Derry~Londonderry, involving walking (and sedentary) interviews with site users/tourists/residents, in addition to an internet mapping exercise, exploring sense of place values, site attributes and development preferences
- Your Heritage North West – at the individual building/monument scale in the Donegal County Council and Derry & Strabane District Council areas, involving students from two local colleges (Northern Regional College and Letterkenny Institute of Technology) defining and inventorying places of cultural significance for each of them, together with explanatory and feedback workshops

2.0 INTRODUCTION

This working paper supports the development of a PPGIS-based methodology and associated mapping tool to capture the diverse range of heritage values ascribed by communities in the cross-border cultural landscape of Derry~Londonderry. The paper underlines the primary focal points of the REINVENT Project concerning methodological learning, embedding knowledge within policymaker/practitioner networks and transforming heritage inventorying processes. The discussion seeks to establish the principal methodological challenges and lessons deriving from past PPGIS studies through an extensive trawl of the peer-reviewed literature. It is recognised that many methodological challenges cannot be entirely overcome and it is not the intention of this paper to elaborate the 'best' methodology, but rather to propose a plausible methodology to guide the fieldwork stages of the research. Furthermore, the paper sets out certain parameters for the selection of cases in the North West, as well as highlighting a range of PPGIS and digital mapping tools potentially applicable to the project. Finally, the proposed cases, PPGIS methods, digital tools and other parameters are elaborated as part of the proposed methodology in the final section.

WP2 represents one of the outputs pertaining to Objective 2 of the REINVENT Project, the overarching purpose, objectives and key deliverables of which are indicated in Figure 1 overleaf. The recommendations emanating from this paper concern the proposed PPGIS methodology and mapping tool, and will hence contribute towards fulfilling the second and third deliverables arising from Objective 2. The approach proposed will be tested in pursuance of Objective 3 of the project, with the PPGIS generated data during the case study fieldwork augmenting the cultural heritage atlas for the cross-border region in the North West centred on Derry~Londonderry. Furthermore, Working Paper 2 complements, and has been written in parallel with, the first working paper focused on the datasets pertaining to the principal heritage inventories on the island of Ireland, their public availability, webhosting of the cultural heritage atlas and guiding principles in the online GIS-mapping of the selected datasets. Both working papers are foundational to the research design of the REINVENT Project.

This paper is structured into seven principal sections. The key focal points of the research are firstly reiterated and reemphasised, with the three broad categories established subsequently helping to structure the discussion of the PPGIS and other literature in the next section. Following this, certain aspirations and constraints informing the selection of potential cases are considered, with a range of cases in the North West representing different categories of heritage and spatial scales listed and briefly profiled. The penultimate section then considers the adaptability and other issues concerning the PPGIS and digital mapping tools written about

in the peer reviewed literature. Finally, the proposed methodology for the fieldwork stages of the REINVENT Project is outlined in the concluding section.

Figure 1: REINVENT Project purpose, objectives and deliverables

RESEARCH PURPOSE	
To develop and test a PPGIS methodology and mapping tool to capture the diverse range of heritage values ascribed by communities in the cross-border cultural landscape of Derry~Londonderry to inform cultural heritage management policies and practices	
OBJECTIVE 1	DELIVERABLE(S)
To map official heritage inventories using GIS, creating an embryonic 'cultural heritage atlas' for the cross-border region in the North West of Ireland centred on Derry~Londonderry	- Cultural heritage atlas - Working Paper 1
OBJECTIVE 2	DELIVERABLE(S)
To develop a public participation GIS-based methodology and associated mapping tool to capture 'unofficial' heritage values ascribed by a range of communities at different spatial scales, exploring potential commercial opportunities for its wider application	- PPGIS-based methodology - Mapping tool - Working Paper 2
OBJECTIVE 3	DELIVERABLE(S)
To validate methodology and mapping tool through pilot cases at different spatial scales, overlaying the unofficial values ascribed by a range of communities with those derived from the official heritage inventories	- Augmented cultural heritage atlas - Working Paper 3
OBJECTIVE 4	DELIVERABLE(S)
To inform spatial planning and cultural heritage management policies and practices and embed knowledge of PPGIS within local cultural heritage management networks	- Final report to Consultative Group

3.0 RESEARCH FOCAL POINTS

This section reiterates and reemphasises the primary focal points of the REINVENT Project with a view to guiding the literature review and informing subsequent decision-making over the proposed methodology and associated mapping tool for the fieldwork stage of the research in the North West. The interrelated focal points are derived from the research purpose, objectives and deliverables elaborated in Figure 1, and they concern methodological learning in the application of PPGIS; engagement with policymaker/practitioner networks to inform policies and practices; and, the transformation of heritage inventorying processes in light of critiques and technological developments, hence the project title 'Re-inventory-ing Heritage'.

3.1 Methodological learning

The research is primarily concerned with the development and testing of a PPGIS methodology and mapping tool. Thus, discussion of the academic literature is initially centred on the methodological learning from experience of the deployment of PPGIS for a variety of purposes, in a diversity of real life contexts, including the implications arising from various technological choices made within published research designs. Of interest in shaping the proposed methodology is the orientation of the research towards heritage values, including value-conflicts and contestation over heritage in cross-border contexts, and the involvement of diverse communities in heritage inventorying processes at various spatial scales ranging from individual buildings to cultural landscapes. The literature review, therefore, necessarily entails scrutiny of PPGIS studies from the recent past which deal in some way with these and/or analogous issues. However, the main objective at this stage is not to propose the 'best' methodology or methods, but rather to elaborate a plausible methodology through which a multiplicity of methods can be tested in relation to several cases in the North West. In short, although the literature review will facilitate an informed judgement and prevent egregious errors from being made in the research design, much of the methodological learning will emerge from the fieldwork and data analysis. Furthermore, from an aspirational point of view, the training-through-research character of the Marie Skłodowska-Curie Fellowship under which the project is supported facilitates the elaboration of a methodology that maximises the opportunities for skills and career enhancement for the researcher.

3.2 Policymaker/practitioner networks

Following on closely from the section above the intention of the overarching research purpose is that the methodological learning in the application of PPGIS is embedded within local

cultural heritage management networks and this inevitably has certain implications for the approach taken. The principal means of achieving this is through the convening of a Consultative Group of spatial planning and cultural heritage policymakers/practitioners with which a two-way dialogue will be maintained throughout the course of the project including regular meetings and workshops. In addition, a final report to this group will be prepared in pursuance of Objective 4 of the project. The research stems from a concern to improve public participatory practices in cultural heritage management, but the most sustained engagement over the two-year project will essentially be with a community of practice and group of policymaker/practitioner 'experts'. A critical justification for this from the academic literature is the suggested political and professional resistance to accepting the 'wisdom of crowds' collated through PPGIS-type digital tools in official decision-making processes, and thus the concomitant necessity to engage with 'early adopters' within policymaker/practitioner networks (Brown, 2015, p.206). However, the irony of principally liaising with expert stakeholders in seeking to encourage bottom-up processes and practices is also recognised, and is potentially problematic for several reasons.

Firstly, certain academic literature on PPGIS and heritage values stress the importance of co-design and co-production in the creation of digital tools if they are to be truly effective in improving participatory practices and democratising decision-making processes (Fredheim, 2016; Taylor and Gibson, 2016; Jones, 2017). The REINVENT Project as initially conceived does not entail co-production with the local community in the development of the PPGIS mapping tool, for example, as is currently being done through the 'Adopting Archaeology' project in the UK involving the Council for British Archaeology and the University of York (Fredheim, 2016). Rather, public engagement was envisaged taking place utilising the mapping tool as an end-product. Although the proposed methodology will be designed to include elements of co-creation, the full emancipatory potential of PPGIS will ultimately remain underexplored. Nonetheless, the critical importance of involving the community from the outset can be stressed in the final report to the cultural heritage policymaker/practitioner in the North West, while those engaged in the PPGIS mapping process during the fieldwork will be exposed to its participatory potential, thus positively impacting on the social capital of the local community.

Secondly, the fact that the learning will predominantly be packaged at the end of the project for local cultural heritage management networks raises several issues. Methodologically speaking, several scholars emphasise that the objective of public participation in PPGIS studies should be identified and defined in advance to avoid confusion and the raising of unrealistic community expectations (Schlossberg and Shuford, 2005). Failure to articulate this

clearly, amongst other things, can lead to poor survey response rates from prospective study participants, hence also impacting on the quality of the spatial data collected and the robustness of the ensuing analysis. Following Rambaldi *et al.* (2006), this also has an ethical dimension in that false expectations within the community should not be raised with organisers remaining open about the objectives of the exercise and what participants should expect from taking part in the process. This underscores the necessity to clearly address such issues through the proposed methodology.

3.3 Heritage inventorying processes

The third focal point concerns inventorying practices in cultural heritage. Inventories are recognised in international and national conventions, treaties and laws as being central to the management of heritage (see, for instance, Council of Europe, 1985). The essentially static nature of paper-based heritage inventories, however, has fundamentally changed in recent years in response to the emergence of digital technologies, with many inventories now largely web based, GIS-mapped and freely searchable online (McKeague and Thomas, 2016). Moreover, the transition from paper-based records to digital ones has been accompanied by new dynamic crowdsourcing capabilities, thereby facilitating the incorporation of publicly-generated material onto official heritage inventories. For example, Historic England recently invited the public to share their knowledge and photographs of historic buildings and places in England as part of their 'Enrich the List' initiative, with curated contributions from the public supplementing the official listing record online (McClelland, 2016; Historic England, 2017). Another notable digital innovation concerns the open-source Arches heritage inventory and management system jointly developed by the Getty Conservation Institute (GCI) and World Monuments Fund (WMF) (Myers *et al.*, 2016). This freely available online platform has facilitated the emergency inventorying of heritage under threat in the Middle East and is being adapted to other contexts, including in the United States and the UK.

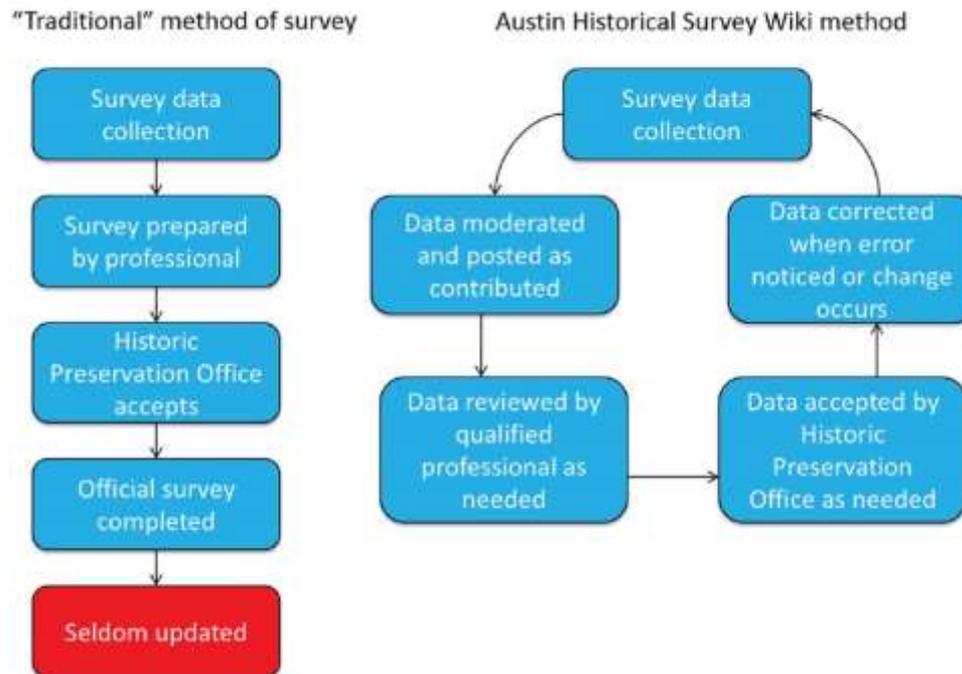
A further dimension of traditional inventories that has been the subject of sustained critique concerns their underpinning by connoisseurial judgement and expert and elite values (de la Torre and Mason, 2002; Smith, 2006; Jones, 2017). Consequently, questions repeatedly posed in the literature include 'who decides what is heritage', 'what get conserved and why' and 'whose heritage is it' (Tunbridge, 1984; Graham *et al.*, 2000; While, 2006). Moreover, as de la Torre (2013, p.155) states, 'values are attributed, not intrinsic; mutable, not static; multiple and often incommensurable or in conflict', meaning that the values ascribed to heritage resources by different people and groups are in a constant state of flux, particularly within diverse and pluralistic societies. Although emphasis on authenticity and the intrinsic

qualities of material fabric has remained an extremely stable value over time (Pendlebury, 2013; Jones, 2017), recognition of the mutable nature of heritage values poses significant challenges in the context of the static nature of heritage inventories in the past and present-day inventorying practices. For instance, the need to incorporate periodic review, updating, and community input into heritage processes is deemed necessary considering changing heritage values for them to more adequately reflect contemporary society (Harrison, 2013; Khalaf and Fredheim, 2016; Jones, 2017). Making space for enhanced public involvement would not only enhance the legitimacy of inventorying processes, but also facilitate the ascription of a broader range of values, including 'social' and 'community' values, and a greater diversity of valuers, within the process.

The Council of Europe's *Faro Convention* makes explicit the desire that everyone should have an opportunity to participate in 'the process of identification, study, interpretation, protection, conservation and presentation of the cultural heritage' (Council of Europe, 2005, p.5). Although public participation in the valuing of heritage is endorsed by many official heritage agencies in the UK, as Jones (2017, p.24) reports, the inclusion of social and communal values remains 'relatively neglected in the designation, management and conservation of heritage places'. By way of illustration, the principal inventorying process for historic buildings in Northern Ireland is the area-based Second Survey undertaken by the Historic Environment Division (HED) of the Department for Communities (DfC). As can be seen from the diagram in Appendix 1, the Second Survey represents a traditional linear process consisting of survey fieldwork, desktop historical research and evaluations solely undertaken by external consultants and public officials in the HED. The public are not proactively engaged in the process, with only the statutorily-mandated Historic Buildings Council (HBC) and the local district councils consulted on the recommendations presented.¹ Furthermore, the online Northern Ireland Buildings Database is simply seen as a receptacle of information at the end of the survey process rather than as a dynamic digital tool with public participatory potential. Although this relates to one category of heritage in one jurisdiction, it is indicative of a wider practice that digital tools have the potential to disrupt. For example, the diagram in Figure 2 neatly captures the conceptual differences between traditional methods and the Wiki tool employed to involve the public in the Austin Historical Survey. Involving the public raises many complex questions, of course, including defining which public, when they should be involved, and the nature of their involvement.

¹ Owners of structures proposed for 'listing' are informed of this fact towards the end of the process, while members of the public or interested groups are free to contact the HED at any point with listing and other ad hoc requests.

Figure 2: Comparison of traditional heritage inventorying methods and the Austin Historical Survey Wiki method



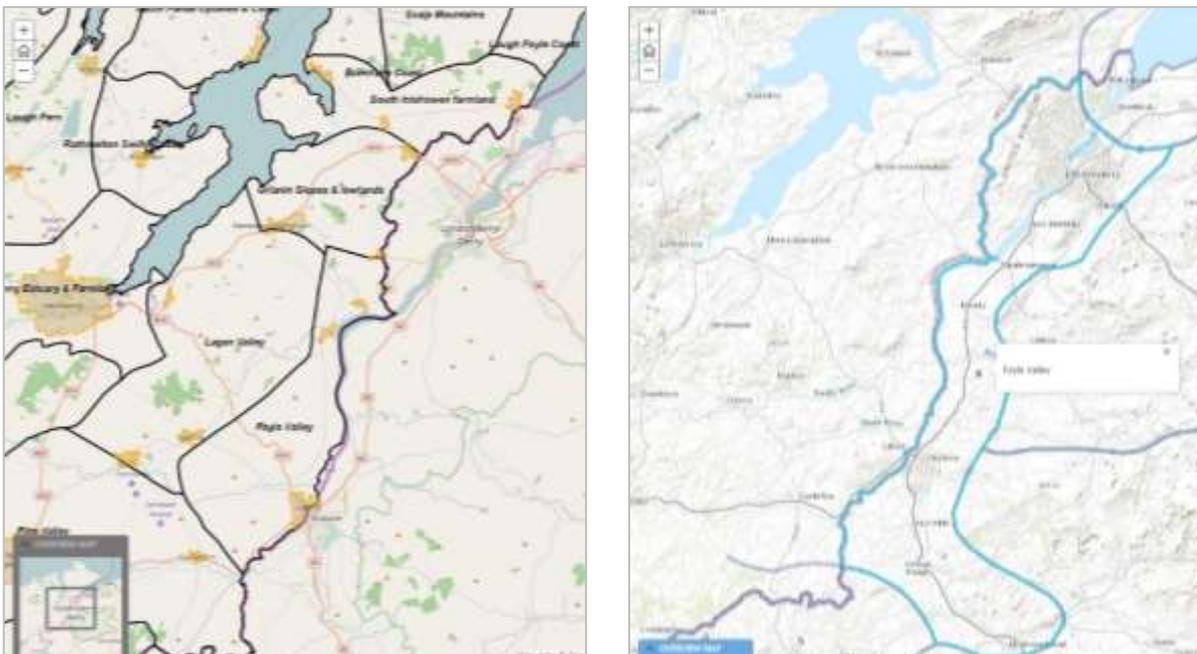
Source: Minner *et al.*, 2015, p.29

The cross-border focus of the research is also potentially disruptive of traditional heritage inventorying processes. For example, the official heritage inventories referenced in WP1 strictly cohere to the jurisdictional boundaries of the organisations responsible for their creation. Thus, although the Northern Ireland Regional Landscape Character Assessment and the Landscape Character Assessment of County Donegal both explicitly state that individual character areas do not neatly coincide with jurisdictional and other boundaries, this is not the impression visually conveyed on their respective online GIS viewers (Figure 3).² However, as Dolff-Bonekämper (2010, p.18) states with reference to the *Faro Convention*, those with an interest in the management of heritage are not necessarily defined 'in terms of the place where the heritage is situated' and heritage communities can be 'local, regional, national or transnational' in their geographic dispersion. The conservation of a building, area or landscape is achieved locally given the locational fixity of such resources, but the concerned 'public' may not simply be confined to those proximate to the resource such as residents. Many others, including visiting tourists, those employed within the area, but living elsewhere, and those that have never visited before, may also want a say in the identification, interpretation and conservation of the heritage of a place. In contested cross-border contexts, where the

² However, both assessments do coincide in that the Foyle Valley is reciprocally recognised as a distinct and coterminous character area, although its visualisation on the respective online GIS viewers is effectively 'partitioned' and not visible to its full extent.

importance of cultural heritage to maintaining good 'relation geographies' between different people and groups is a public policy imperative (McClelland, 2016), operationalising the participation of a cross-border public presents even greater challenges than experienced elsewhere. The capacity for PPGIS and online digital tools to reach multiple audiences is clear, but so too are their potentially disruptive qualities for traditional heritage inventorying processes and the expert systems and jurisdictional boundaries to which they are tied.

Figure 3: Screenshots of the Northern Ireland Regional Landscape Character Assessment (right) and the Landscape Character Assessment of County Donegal (left) indicating the 'partitioned' location of the Foyle Valley character area



4.0 LITERATURE REVIEW

This section addresses the academic literature on PPGIS, dealing firstly with several preliminary issues such as definitions and the focus of previous PPGIS studies before progressing to discuss more substantive matters clustered around the key research focal points reviewed in the previous section. The intention is to review the existing academic literature on PPGIS with a view to informing the methodology proposed for the fieldwork stages of the project in the North West. To this end, searchable databases including Scopus and Google Scholar assisted in the identification of peer-reviewed literature on PPGIS, with key word combinations, in line with the focal points discussed in Section 3, including 'methods', 'heritage values', 'public participation' 'conflict' and 'inventorying'. A snowball strategy was also employed whereby several comprehensive review articles, for instance, Sieber (2006) and Brown and Kytta (2014), were useful in identifying PPGIS-themed publications. In addition, a literature trawl undertaken prior to the REINVENT Project funding application in the summer of 2015 yielded numerous results already in the possession of the researcher. Most of the articles pertain to the developed world, particularly Europe, Australasia and north America, and, while many PPGIS studies evidently focus on such topics as landscape values mapping, ecosystem services, and an increasing number of urban applications, few relate to historic environment conservation or heritage inventorying processes. For example, a keyword search for 'PPGIS' in journals specifically focused on heritage, including the *International Journal of Heritage Studies*, *The Historic Environment: Policy & Practice* and the *Journal of Cultural Heritage Management and Sustainable Development*, produced no results, although words such as 'mapping' were more successful.

4.1 PPGIS definition(s) and applications

Although a singular definition of PPGIS remains 'nebulous' it is generally taken from the literature to refer to a system of collecting geospatial information, in recent years most commonly through web applications, from 'non-experts' and the 'lay public' (Tulloch, 2008; Brown *et al.*, 2014; Huck *et al.*, 2014). The term is said to originate from a meeting in 1996 of the National Center for Geographic Information and Analysis (NCGIA) in the United States, with the 'original' definition coined by Schroeder (cited in Sieber, 2006, p.492), who describes PPGIS as 'a variety of approaches to make GIS and other spatial decision-making tools available and accessible to all those with a stake in official decisions'. The community development origins and emancipatory potential of PPGIS as a means of engendering greater community involvement in decision-making processes is noted by numerous scholars, but so too are the more problematic aspects of its real world application, whether due to the so-called

'digital divide', the difficulties in defining the 'public' and the potential to reify divisions or create conflict where it previously did not exist (Schlossberg and Shuford, 2005; Sieber, 2006; Dunn, 2007; Elwood, 2010; Radil and Jiao, 2016). These are discussed later in this review. Such complications, together with what Brown and Kyttä (2014, p.126) characterise as the 'intellectual tug of war between its dominant components', namely public participation as social processes and GIS as technology, will most likely ensure that an agreed definition of PPGIS will not be forthcoming.

The lack of an agreed definition of PPGIS is further complicated by its overlapping with several other geospatial technologies and approaches involving the public, including Participatory Information Systems (PGIS) and Voluntary Geographic Information Systems (VGI). The characteristics and distinctions between these closely related applications are explained by Brown and Kyttä (2014) according to the dimensions of purpose, geographic context, sampling approaches and dominant mapping technology, amongst several other factors. Although the lines between each are blurred, the situational context within which each is applied is apparently of paramount importance, with PPGIS typically used to enhance public involvement in developed countries, particularly in land use planning and management processes, whereas PGIS often refers to community empowerment initiatives in developing countries (Brown and Kyttä, 2014; Jarvis *et al.*, 2016). As such, the latter is characteristically initiated by non-governmental organisations in rural areas with capacity building objectives ranked higher than the quality of the mapped outputs. The former is used in regional and urban contexts to aid decision-making processes and hence the quality of the mapped data is of primary importance, with greater attention afforded to the sampling approach and similar methodological issues. In contrast, VGI is used in both developed and developing world contexts and is predominantly aimed at increasing the amount of spatial data voluntarily collected and disseminated by individuals, with the growth of GeoWeb 2.0 technologies and sensory-enabled mobile devices driving the phenomenon of 'crowdsourcing' and VGI. The distinctions between these three applications are not hard and fast, however, and a degree of methodological overlap inevitably occurs

The diverse applications of PPGIS have burgeoned in recent years to encompass a broad range of rural and urban contexts and public policy challenges. For instance, PPGIS has been applied to national park planning, the management of ecological systems, measuring the attractiveness of rural landscapes, the identification of local ecosystem services, and flood risk management (White *et al.*; 2010; Brown and Weber, 2011; Plieninger *et al.*, 2013; de Vries *et al.*, 2013; Ives and Kendal, 2014; Brown and Fagerholm, 2015). It has recently been adapted to the emergent issue of marine spatial planning in Australia (Strickland-Munro *et al.*, 2016),

while, in urban contexts, particularly in Scandinavian countries, PPGIS studies have focused on such subject matters as achieving sensitive urban densification (Kyttä *et al.*, 2013; Babelon *et al.*, 2016), the social sustainability of urban settings (Kyttä *et al.*, 2016), active travel choices for school children (Broberg and Sarjala, 2015), and public participation in the Helsinki master planning process (Kahila-Tani *et al.*, 2016). Indeed, with respect to the real-world application of PPGIS in urban planning, Babelon *et al.*, (2016) suggest that academic research now lags behind in its analysis of the increasing deployment of commercial and open-source PPGIS platforms by public, private and third sector agencies. As noted previously, its application to heritage inventorying has been minimal to date, although several US examples are discussed later. However, its adaption for this purpose is only likely to increase in the future, for, as Fredheim (2016, p.117) states in the context of the increasing responsibility placed on local communities for the management of heritage, such ‘transfer of agency...cannot be made upon the assumption that the marginalisation of “social values” should continue’.

4.2 Methodological choices

It is evident from the literature that a diverse range of methods have been used within PPGIS studies and many combinations of online and offline engagement activities are potentially appropriate for the REINVENT Project. Brown and Kyttä (2014) inform that the most common data collection approaches in PPGIS involve self-administered surveys, key informant interviews, and community workshops, while focus groups have also been utilised within group mapping exercises. The use of the latter methods typically results in the collection of more qualitative information than is the case with survey methods and a series of trade-offs are clearly involved in deciding the appropriate methodological approach. For instance, Pocewicz *et al.* (2012) evaluate paper versus internet mapping methods through a survey of important places and development preferences targeted at residents in rural Wyoming (e.g. indicating responses on a printed map sent in the mail versus those completed via an online tool). They found that paper-based methods elicited a higher response rate, lower participant bias, and a higher number of mapped attributes, although the two modes applied to the same case produced a similar spatial results pattern. In contrast, when comparing workshop versus survey PPGIS methods in forest management in Alaska, Brown *et al.* (2014) found that participants identified significantly different landscape values between the two processes, raising questions about the merits of using participatory mapping data from workshops in planning decision support. In the Kyttä *et al.* (2013) study of urban densification in Finland 15,982 letters were mailed to residents in eleven neighbourhoods, undoubtedly requiring a significant investment of financial and other resources. Thus, the methodological choices in PPGIS studies have potentially far-reaching implications impacting on resources, the

credibility of the research findings, and applicability of the process to real-world policy problems.

The key methodological decisions faced by the designers of PPGIS studies include the choice of attributes to be mapped (e.g. landscape values, development preferences etc.), the sampling strategy (who does the mapping?), the purpose of the study, the technology to be used (e.g. paper or digital maps, desktop or mobile devices), and the location where the mapping is done (e.g. online at home or in the field, in workshop venue etc.) (Brown and Kyttä, 2014). For Schlossberg and Shuford (2005, p.22), methodological emphasis should firstly be placed on delineating who the public is, and the character of the participation desired, with the former embracing such categories as decision makers, implementers, affected individuals, interested observers, and the random public. Many of the PPGIS studies referenced in the peer-reviewed literature were explicit about the public targeted and engaged methods used (and hence also the sampling strategy deployed), whether involving locals through representative household samples (de Vries *et al.*, 2013; Plieninger *et al.*, 2013; Kyttä *et al.*, 2013), stakeholders or communities of interest (Strickland-Munro *et al.*, 2016; Babelon *et al.*, 2016), the random public (Kahila-Tani *et al.*, 2016), or a combination of publics and sampling strategies (Brown and Raymond, 2014; Brown *et al.*, 2015; Brown, 2017). Furthermore, Besser *et al.* (2014) elaborate upon several other PPGIS methodological choices, making specific reference to landscape values mapping, which have important technical and functional considerations. These include the mapping scale used (regional, local or multiple), the selection of base map and the amount of predetermined information that it contains (e.g. features and labels for orientation purposes), and the mapping formats and features preferred (e.g. points, lines and/or polygons). Some of the latter issues are considered below in more detail.

Many of the PPGIS studies reviewed elaborated on the most salient technical and functional decisions associated with internet mapping, in addition to the choice of methods and sampling strategies employed. Concerning the selection of base map, numerous studies preferred the Google Maps interface (for instance, de Vries *et al.*, 2013; Brown and Kyttä, 2014; Huck *et al.*, 2014; Strickland-Munro *et al.*, 2016), which stems, for Huck *et al.* (2014, p.231, from its 'functionality, and familiarity to the public as a result of its pervasive presence across the web and mobile devices', although assumptions about its ease of use are not universally shared (Poplin, 2015). In some urban contexts, other interfaces were evidently utilised, including OpenStreetMap, aerial photographs and tailored address maps (Jankowski *et al.*, 2015; Brown and Kyttä, 2014). With regards to mapping formats and features, locating points on online base maps through dragging and dropping appears to be the most common mapping

method, at least in relation to landscape values, as it is 'easy for participants to understand and simple to process and analyze' (Besser *et al.*, 2014, p.147). Many the ecosystem services PPGIS studies identified by Brown and Fagerholm (2015) also used point data, while a smaller number were concentrated on the drawing of polygons. The main advantages and disadvantages of these approaches are discussed by several scholars, for example, with Brown and Pullar (2012) suggesting that using points to map landscape values ensures a lower probability of misidentifying hotspots of values, although dot-density mapping requires a larger number of participants to sufficiently aggregate for hotspot identification. Using multiple geometries also has strengths and weaknesses, with polygons and lines required in certain instances to adequately represent the phenomenon being studied, with polygons particularly useful at displaying participants 'perspectives of scale, shape, and extent of their landscape meanings' (Morse *et al.*, 2014, p.559). However, this requires greater knowledge and skill in the use of digital mapping tools on behalf of the participants, which may cause problems for some. In addition to acquiring background, demographic and other such information, questions or space for free comments can also elicit clarification from participants on the location of the drawn points, lines or polygons.

4.3 Heritage values

PPGIS methods, for Brown (2015, p.207), 'excel in the identification and mapping of place-based social values and land use preferences' and large number of studies in the reviewed literature relate in some way to the attribution of values. Examples of the different terminology used and types of values, frequently referencing the same thing under a different name, include landscape values (Beverly *et al.*, 2008; Zhu *et al.*, 2010; Brown and Brabyn, 2012), ecosystem services values (Plieninger *et al.*, 2013; Brown *et al.*, 2015), place values (Strickland-Munro *et al.*, 2016), and social values (Tyrväinen *et al.*, 2007; Ives and Kendal, 2014). For illustrative purposes, ecosystem services value categories used in a recent study of management preferences among the public in protected areas in Norway and Poland, and their operationalised definitions, are shown in Figure 4. The mapping of landscape values is arguably the most prevalent (Ives and Kendal, 2014), and different typologies have been defined and tested to this end, most prominently by Brown and Reed (2000), whose typology was later adapted for a range of other studies (Brown and Kyttä, 2014). However, as noted by Brown and Kyttä (2014), the development and application of a singular, definitive landscape values typology appears unlikely, and a degree of customisation will inevitably be required for each study given the diversity of places, scales and participants. Moreover, it is important to emphasise that the landscape values are taken to represent a type of 'relationship' value, bridging the 'held' values representing the ideas or principles individually important to people,

and the ‘assigned’ values concerning the ‘conceptions of what appears important to the individual in the physical landscape’, both of which interact in the ‘attribution of meaning and the valuing of specific landscapes and places’ (Brown and Weber, 2012, p.317). In other words, as Ives and Kendal (2014, p.68) succinctly put, a distinction is made between the underlying values (held) that ‘help shape the judgements...about the world around them and why different people and social groups make the decisions they do’ and ‘those things [valued objects] in the world that are valued [assigned] by people’.

Figure 4: Ecosystem values and their operational definitions as defined by Brown *et al.*

Ecosystem values	Operational definition
Hunting/fishing	Areas are important because of hunting and/or fishing
Pastures/grazing	Areas are important because they are used for haymaking and pastures for reindeer, sheep, cows
Gathering	Areas are important for berries, mushroom or collecting herbs/plants here
Water quality	Areas are important because they provide clean water
Biological diversity	Areas are important because they provide a variety of plants, wildlife, and habitat
Recreation	Areas are important for outdoor recreation activities (e.g., camping, walking, skiing, alpine, snowmobiling, cycling, horse riding etc.)
Scenic areas	Areas are important because they include beautiful nature and/or landscapes
Culture/identity	Areas are important because of their historical value, or for passing down the stories, myths, knowledge and traditions, and/ or to increase understanding of the way of life of our ancestors
Income	Areas are important because they provide tourism opportunities, mining, hydroelectric power or other potential sources of income
Naturalness	Areas are relatively untouched, providing for peace and quiet without too many disturbances
Social	Areas are important because they provide opportunities for social activities (e.g. associated with fireplaces, picnic tables, ski-or alpine arrangements, shelters, shared cabins, cabin complexes)
Spiritual	Areas are important because they are valuable in their own right or have a deeper meaning: emotionally, spiritually, or religious
Therapeutic/health	Place are valuable because they make me feel better, either because they provide opportunities for physically activities important for my health and/or they give me peace, harmony and therapy
Special places	Please describe why these places are special to you

Source: Brown *et al.*, 2015, p.93

A key methodological choice with values mapping concerns whether values should be preassigned. For Besser *et al.* (2014), predefining the values that participants then ascribe to different parts of a mapped landscape has the advantage of aiding the coding and aggregating of the spatial data collected, while facilitating cross-study comparisons. On the other hand, participants may have different understandings of the meaning of the predefined value, even when a definition is provided. The other values mapping method, which Brown *et al.* (2014) call inductive (as opposed to deductive), involves the coding of landscape values from participant text where no predefined values are provided. This approach, while allowing people to elaborate what they value in their own words, presents challenges post-mapping with the interpretation and categorisation of value classes from the text, although certain computer software packages may be of assistance in this regard (Besser *et al.*, 2014). A mixture of the two approaches is also possible, of course. For instance, the process of arriving at the predefined values may involve aspects of co-creation and public engagement, with Strickland-Munro *et al.* (2016) initially undertaking interview-based research prior to determine a set of place values associated with the Kimberley coast in Australia, which were later used in their internet mapping survey. As with the mapping formats and features, however, asking for

additional qualitative textual data can assist with clarification of why participants placed values at particular points in a map and what those places mean to them.

Figure 5: Typology of heritage values and descriptions as adapted by Veldpauw and Roders

Traditional	Aesthetic	Artistic, original product of creativity and imagination; product of a creator, conceptual, authentic exemplar of a decade, part of the history of art or architecture
	Age	Value oriented toward the production period; maturity, a piece of memory, reflecting the passage/lives of past generations; the marks of the time passage (patina) present on the attribute
	Historic	A potential to gain knowledge about the past; a testimonial of historic stylistic or artistic movements, or to concepts which are now part of history; related to an important event in the past; archaeological connection with ancient civilization
	Scientific	An original result of human labour or craftsmanship; technical or traditional skills and/or connected materials; integral materialization or knowledge of conceptual intentions
Community	Social	Spiritual, beliefs, myths, religions, legends, stories, testimonial of past generations; collective and/or personal memory or experience; cultural identity; motivation and pride; sense of place; communal value; representation of social hierarchy/status; anthropological or ethnological value
	Ecological	The (spiritual or ecological) harmony between the building and its environment (natural and man-made); identification of ecological concepts on practices, design, and construction; manufactured resources to be reused, reprocessed, or recycled
Process	Political	Educational role for political targets (for example, birth-nations myths, glorification of political leaders); part of management or strategies and policies (past or present) or for the dissemination of cultural awareness explored for political targets; representing emblematic, power, authority and prosperous perceptions
	Economic	The function and utility of the heritage, expired, original, or attributed; the option to use it and/or bequest value for future generations; the role it might have (had) for market or industry; property value

Source: Veldpauw and Roders, 2014, p.257

The use of value typologies in the conservation and management of the built and archaeological heritage is a well-established practice stretching back to the early twentieth century (Mason, 2002; McClelland *et al.*, 2013; Fredheim and Khalaf, 2016). Numerous heritage value typologies exist deriving from multiple governmental and non-governmental sources, including those identified by Fredheim and Khalaf (2016) in Appendix 2, in addition to the typology elaborated by Veldpauw and Roders (2014) shown in Figure 5. These typologies group the values potentially attributed to a place according to such traditional

characteristics as aesthetic, age and historical interest, with a broader range of social and communal values reflected in some of the more contemporary typologies, particularly those influenced by the various iterations of the Australian ICOMOS Burra Charter and the Council of Europe's Faro Convention. However, a values-based approach to heritage management and the use of value typologies have been critiqued in the academic literature, for example, with typologies seen as being inherently reductionist in nature and values-based approaches arguably inappropriate for certain types of heritage site (Poulios, 2010; McClelland *et al.*, 2013; Fredheim and Khalaf, 2016). Moreover, heritage values are recognised as being 'attributed, not intrinsic; mutable, not static; multiple and often incommensurable or in conflict' (de la Torre, 2013, p.155), albeit the outworking of these conceptual understandings remains patchy in practice, particularly in relation to official heritage organisations affording greater prominence to 'non-expert' social and communal values (Jones and Leech, 2015; Jones, 2017). In part, as Jones (2017) reflects, this is a methodological issue, with social research methods such as qualitative interviews and focus groups more effective in eliciting social values from the community. These methods are still not prevalent in their usage within heritage organisations and the REINVENT Project will clearly seek to partially redress this lack through the elaboration of a mixed-methods approach to public participation in heritage inventorying processes using PPGIS.

4.4 Engaging diverse communities

The asserted promise of digital technologies such as PPGIS is that they can facilitate the participation of a greater number of people from heterogeneous backgrounds in public policy processes, thereby improving outcomes, increasing the legitimacy of decisions and building social capital within the community (Brown and Raymond, 2014; Radil and Jiao, 2016; Babelon *et al.*, 2016; Kahila-Tani *et al.*, 2016). Traditional public participation methods, often involving public hearings, workshops, and face-to-face meetings, have been disappointing in the past at engaging diverse communities, whether because place and time commitments effectively preclude many from attending, or because they tend to disproportionately attract development interests or activist groups (Brown and Kytä, 2014; Kahila-Tani *et al.*, 2016). For Jankowski *et al.* (2015, p.905), the problem that 'digressive, rambling, and off-the-subject comments' sometimes dominates traditional public meetings can essentially be overcome by digital tools and online geo-questionnaires. Furthermore, completing internet-based PPGIS surveys at home is not only convenient for certain participants, but is arguably better at ensuring independent views are expressed, especially as stronger personalities in group settings frequently influence the judgement of others (Brown, 2015; Kahila-Tani *et al.*, 2016). It also carries significant advantages for those organising the participation, whether because

of the rapidity with which such online surveys can be conducted, as well as the sidestepping of the sometimes-confrontational atmosphere at public meetings, and the potential reduction in time required for data entry with improved precision in mapping accuracy (Pocewicz *et al.*, 2012). Nonetheless, as Kleinhaus *et al.* (2015, p.241) underline, digital public participation tools are 'not a panacea', and significant issues are evident from literature concerning their wider application.

One of the principal challenges to reaching a diverse audience through PPGIS is the so-called 'digital divide', which refers to the gap between those with the requisite computer knowledge, skills and access to appropriate hardware/software and internet connections, and those that do not for whatever reason (Rinner and Bird, 2009; Huck *et al.*, 2014). Implicated with these technological questions are a series of social dimensions influencing the inclusiveness of PPGIS processes, which, for Radil and Jiao (2016, p.204), concern the 'identities of the participants and the ability to reach across socially constructed but salient identity categories, such as class, race, gender, and so on'. For example, a participatory bias exists in internet-based mapping exercises towards older, formally educated men with higher incomes, and an under-representation of ethnic groups (Brown and Kytta, 2014). Gottwald *et al.* (2016) focus on the physical and cognitive challenges facing older adults in using online mapping tools, which is an increasingly important topic given that they represent one of the fastest growing internet user age groups. Indeed, Kahila-Tani *et al.* (2016) note the criticism of the age profile of those taking part in the Helsinki Master Plan PPGIS survey, with some at the face-to-face meetings seeing it as problematic that so many young people had an opportunity to express their opinion online – presumably to the exclusion of older voices. The representativeness of such studies cannot be taken for granted, therefore, and nor should a 'false authority' be placed on their findings (Huck *et al.*, 2014, p.230). The assumption that PPGIS and other digital engagement tools will automatically result in the participation of diverse communities is clearly more complicated to achieve in practice.

In terms of ensuring the involvement of diverse communities in PPGIS studies, recommendations emanating from the literature include the necessity to combine a range of online and offline techniques (Meng and Malczewski, 2010; Babelon *et al.*, 2016). Paper-based methods, whether through workshops or 'on-street' mapping, can assist with engaging 'hard-to-reach' groups (Cinderby, 2010), but a combination of online and offline engagement tools is recommended for participatory processes to 'include both technologically-savvy citizens and the "slow adopters"' (Kleinhaus *et al.*, 2015, p.211). The multiple channels used to communicate with the prospective diverse public are clearly important, as are a range of other factors pertinent to the organisation of conventional participation methods, including the

appropriate location of meetings taking into consideration the 'geographies of diversity within a particular place' (Radil and Jiao, 2016, p.209). For Brown and Kytta (2014, p.131), sampling design also has a significant bearing on the representativeness of PPGIS processes and, if poorly handled, can result in paradoxical situations that 'reinforce existing power relationships' rather than enfranchising 'marginal or under-represented segments of society'. Including a random sample of the public in PPGIS studies can help ensure a degree of representativeness and counters the skewing effect that special interests can sometimes have on the mapped results. However, combining a random sampling element with an open data collection process is evidently not always desirable from a policymaker/practitioner perspective, as discovered by Kahila-Tani *et al.* (2016), although this would have ensured that participation was open to everyone while reducing criticisms of an unrepresentative dataset that cannot be relied upon to make public policy decisions.

Another innovative ethnographic method worth considering is the walking interview. For Evans and Jones (2011, p.849), walking interviews provide an ideal means through which to explore peoples sense of place and values, providing 'richer data' due to the fact that interviewees are 'prompted by meanings and connections to the surrounding environment and are less likely to try and give the "right" answer'. Indeed, they contend that walking interviews produce qualitatively different research data from traditional sedentary ones, with the former resulting in evidence about how people 'relate specifically to place', rather than biographical accounts of interviewees history 'in place' (Evans and Jones, 2011, p.856). This distinction makes the walking interview method attractive to the kind of research proposed in the REINVENT Project. This technique was applied on a variety of research ranging from investigations of the recovering process of those suffering from ill health and physical disability (Carpiano, 2009; Butler and Derrett, 2014), to explorations of people's diverse and sometimes problematic engagements with the (urban and rural) environment and landscape (Ingold and Lee, 2008; Inwood and Martin, 2008), with the variant 'go-along' approach involving interviews of participants as they perform their daily routines (Kusenbach, 2003; Evans and Jones, 2011). Furthermore, spatial and locational data can also be collected through GPS technology and allied to the verbal information elicited during the walk, providing a connection, in the words of Jones *et al.* (2008, p.1, 4), between 'what participants say with where they say it', thereby unlocking 'the potential of walking interviews for tackling more explicitly spatial issues'. Usefully, such thinking has been extended to heritage-related research as demonstrated by the #invadeDurham project under which the public was invited to co-create cultural values and engage with, and voice, their feelings on the cultural heritage of the Durham World Heritage Site in northern England (Davies *et al.*, 2016). Walking interviews facilitated the collation of

qualitative data from multiple participants providing a richer sense of the living heritage of the place and the kind of social values ascribed to the built environment by a diverse public.

4.5 Conflict and contestation

For managers and policymakers to successfully mediate between the competing uses of cultural heritage it is necessary to identify value conflicts and dissonance and seek to manage them appropriately over time (Tunbridge and Ashworth, 1996). Public participatory tools such as PPGIS are useful for this purpose and have been applied in many diverse settings to identify existing or potential contestation over planning and conservation management decisions. For instance, Brown and Raymond (2014) utilised PPGIS in a land use planning study in New South Wales, Australia, where they sought to elicit information from residents in relation to their attributed landscape values and preferences over the location of residential and industrial development. In short, the researchers proposed that the highest potential for land use conflict occurs in areas 'where there is development preference disagreement (a large difference between areas of acceptable and inappropriate development preference) and high place importance (high landscape value intensities) (Brown and Raymond, 2014, p.197). Mapping the attributes of landscape values and development preferences provides an early indication as to where social conflicts over land uses may arise. Other studies overlaying the values and preferences attributed by residents include those assessing sensitive urban densification in the Helsinki metropolitan area (Kyttä *et al.*, 2013), the social acceptability of marine protected areas management alternatives in Australia (Strickland-Munro *et al.*, 2016), and the perception of ecosystem services and disservices in a cultural landscape in eastern Germany (Plieninger *et al.*, 2013). By generating a 'soft' layer of knowledge from the public through PPGIS on the social acceptability of certain courses of action and the location of valued places, more 'contextually sensitive planning' is possible when decision-makers are more attuned to potential sources of conflict (Kyttä *et al.*, 2013, p.31).

The studies referenced above were elaborated as part of strategies aimed at the positive management and amelioration of potential conflict over conservation and land use. PPGIS is usefully employed to acquire social data for use within decision-making processes, particularly where scientific, economic and other expert-derived knowledge often fails to consider local or lay public knowledge. As Brown (2017, p.54) states, land use planning and management often involves 'wicked social value problems that do not have technical solutions', hence the desirability of adapting PPGIS towards identifying 'important social trade-offs in the distribution of costs and benefits'. Thus, the incorporation of social research into decision-making may conceivably have prevented the economic displacement of artisanal fishers from marine

protected areas in southeast Asia, the introduction of which were otherwise deemed a conservation success following their designation (Strickland-Munro *et al.*, 2016). However, it is recognised that digital public participatory projects can also lead to ‘disempowerment and abuse’ rather than ‘emancipation and egalitarianism’ (Perry and Beale, 2015, p.156). Indeed, PPGIS may open a ‘Pandora’s box of conflict within or between different stakeholder groups’, perhaps through ‘transforming vaguely demarcated boundaries on the ground into clearly defined lines on a map’, which may create tensions where they might not previously have existed (Dunn, 2007, p.620). For example, a degree of skepticism and suspicion greeted the introduction of the Austin Historical Survey Wiki web tool, particularly among some African American and Latino residents concerned that it may become implicated within gentrification processes in their neighbourhoods (Minner *et al.*, 2015). Consequently, ethical and sociopolitical awareness is needed when designing and implementing PPGIS studies in specific local contexts to avoid the creation or exacerbation of conflict, although this is arguably more acute in developing country contexts.

4.6 Embedded within policy networks

The PPGIS literature suggests that it has yet to be fully embraced by policymakers and public agencies or integrated into their decision-making processes (Brown *et al.*, 2014; Brown, 2015; Brown and Fagerholm, 2015). For Brown (2015, p.207), the greatest resistance to the use of public participatory mapping processes comes from politicians, planning professionals, NGOs and others who believe that ‘expert knowledge is superior to crowd wisdom’. In part, this stems from the widely-held belief that the origin of intelligence resides in expert individuals rather than with the lay public, meaning that even a well-conceived PPGIS study that produces demonstrably ‘wise’ results, may not be trusted by public authorities due to the existence of such deeply held assumptions (Brown, 2017). For PPGIS to have greater influence within policy networks requires that established power structures accept that ‘lay segments of society have valuable knowledge and experiences, beyond mass opinion, that can substantively contribute to land planning and management decisions’ (Brown and Kyttä, 2014, p.132). Several determinants are advanced as to how it can be taken seriously in natural resource planning and decision support, including the importance of ensuring the quality of PPGIS derived data, particularly the dimensions of positional accuracy and data completeness (Brown *et al.*, 2015). Related to this point, advocates of PPGIS as a participatory and decision support tool are implored to showcase its utility through generating empirical evidence, particularly through collaborating with political and professional ‘early adopters’ in sponsoring innovative demonstration projects (Brown, 2015). Therefore, a necessary step in successfully embedding knowledge of PPGIS within local cultural heritage management networks will entail

persuading policymakers/practitioners of its demonstrable benefits in augmenting traditional expert-led processes.

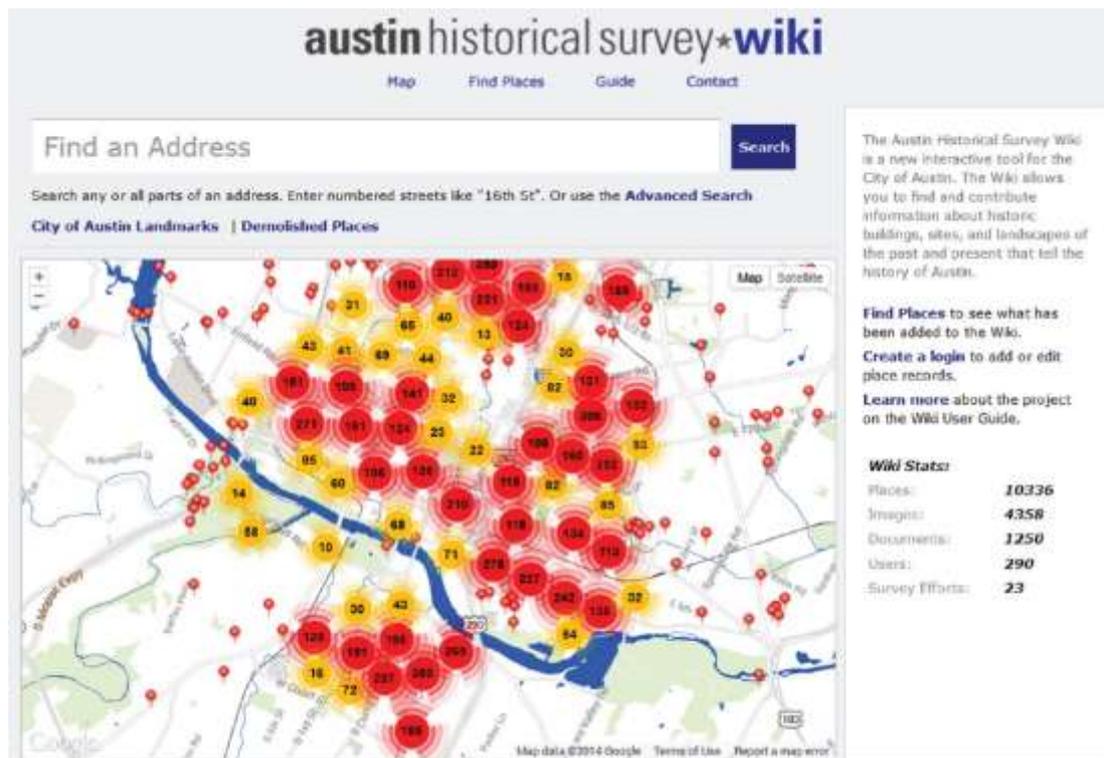
A further characteristic of PPGIS studies that has impacted on the use of such tools by planners and other policymakers/practitioners concerns the sporadic nature of the interventions and the concomitant absence of a long-lasting role within public policy processes (Kahila-Tani *et al.*, 2016). Indeed, many studies are essentially conceived to address specific academic-focused research questions or test the functionality and performance of mapping tool prototypes, without evaluating barriers to their uptake and use by public authorities (Babelon *et al.*, 2016). However, the Helsinki master planning process begun in 2013 represented the first time that PPGIS was integrated into the early phases of a major city's plan, garnering observations from 32,000 residents (Kahila-Tani *et al.*, 2016). Moreover, the Finnish government earlier commissioned the development of national PPGIS software for use by public agencies, prompting some to speculate that countries such as Finland may act as 'bellwethers' for others in the wider adoption of participatory mapping technologies (Brown, 2015; Brown and Fagerholm, 2015). Although Scandinavian countries may be more culturally inclined towards embracing new technology in participatory processes (Brown, 2015), Babelon *et al.* (2016) explore the hurdles to the uptake of PPGIS in Swedish municipalities, while Kahila-Tani *et al.* (2016) acknowledge that planners in Helsinki found it challenging to use in their day-to-day practice. Among the recommendations advanced is the need for longitudinal research focused on better understanding the outcomes of PPGIS studies and generating critical feedback on 'what works, how and in which contexts' (Babelon *et al.*, 2016, p.20).

The challenges of research-policymaker/practitioner exchange and knowledge transfer are not confined to PPGIS, of course, and have been the subject of much debate in other disciplinary arenas including urban planning. For instance, in a recent Interface section of the journal *Planning Theory & Practice*, Hurley *et al.* (2016, p.447) acknowledge that the relationship between 'research and practitioner endeavor is not easy and straightforward', but that exchange between the two 'is essential to the development of both disciplinary knowledge and professional practice'. Improving exchange, for the Interface authors, will require researchers to use clear language and tailored formats for presenting research evidence; to actively engage in policy processes; and to foster mutually beneficial collaborations with policymakers/practitioners. Perhaps more importantly, both researchers and policymakers/practitioners need to better understand 'each other's different ways of thinking and working...their different limitations and the specific needs and professional standards' (Hurley *et al.*, 2016, p.473). The apparent successes of the Helsinki master planning process

were built on long-standing collaboration between researchers at Aalto University and local planners, which initially manifested in the creation of a SoftGIS methodology and subsequently with the development of a 'do it yourself' map-based questionnaire service called 'Maptionnaire'. Crucially, the involvement of planners from an early stage ensured the relevance of the 'soft' geocoded information to the planning sector, while close cooperation in the Helsinki process included the co-elaboration of key themes and advertising of the PPGIS survey by the city authorities (Kahila-Tani *et al.*, 2016). As with the local community, involving policymakers/practitioners in co-creation and co-production represents an ideal situation.

4.7 Heritage inventorying processes

Few academic studies relate to the use of PPGIS within heritage management and even fewer to its potential application within inventorying processes. The *Journal of Cultural Heritage Management and Sustainable Development* recently devoted an issue to cultural heritage inventory systems in which Myers and Quintero (2016) stressed that the recording and documentation of heritage 'merits greater attention than it has received in recent years'. The predominant focus of the journal issue is on the evolution of national inventories in selected countries and cities and their transitioning towards digital platforms (Carlisle and Lee, 2016; Shah, 2016; McKeague and Thomas, 2016), including the digital and open-source Arches heritage inventory and management system referenced earlier (Myers *et al.*, 2016). None of the authors directly address the issue of increasing community participation in the co-creation of heritage inventories using GIS. However, Minner (2016, p.77) notes several examples of 'community-wide survey efforts' and 'public participatory mapping' in the United States discussed in the academic literature, including SurveyLA (Bernstein and Hansen, 2016) and the Austin Historical Survey Wiki (Binner *et al.*, 2016) (see Figure 6). The former involved the development of a GIS-based mobile survey application, with an associated public participation and outreach programme utilising online engagement and social media to reach the diverse communities of Los Angeles. A customised version of the GCI's Arches software facilitates the ongoing management and public access to the SurveyLA data through the HistoricPlacesLA website. In Austin, a university-based team created a web tool that enables citizens to contribute to identifying city-wide heritage resources with a view to the information being utilised within local government decision-making, including in advance of potential conflicts over development (Minner *et al.*, 2015). The tool emerged through a partnership between the university, a local preservation society, an NGO, and the City of Austin's planning department and historic preservation office, and is a pertinent example of community involvement in heritage inventorying processes using digital tools.

Figure 6: Screenshot of the Austin Historical Survey Wiki

Source: Minner *et al.*, 2015, p.

Assuming the advantages of enhancing public participation within heritage inventorying processes through PPGIS (or other such online and/or offline tools) are broadly accepted, several methodological considerations require thought before it can be operationalised in practice. Firstly, the question of defining which public is undoubtedly complicated by the issues of scale and proximity and the weighting afforded to the spatial information attributed by different publics. For example, should only a local and proximate public be invited to participate in such processes, particularly given that tourists and locals are likely to value things very differently? Plieninger *et al.* (2013) note several studies indicating the differing perceptions of ecosystem services at popular recreational destinations for outside visitors, with locals prizing the 'built capital' of their villages more highly than tourists who visited the area primarily for the 'natural capital' and recreational opportunities available in the landscape. Other related issues are discussed by Brown *et al.* (2015), including the propensity for people to identify more positive values nearer their own home rather than further away ('spatial discounting'), and the problems of scale when urban and non-urban areas are included within a study area. Concerning the latter, the values of areas with less conservation importance (as defined by conservation experts) within the greater Melbourne area were disproportionately mapped, reflecting the large number of participants from the city region in addition to the relative scarcity of urban parks and green spaces, thereby heightening their 'perceived conservation value to

residents' (Brown *et al.*, 2015, p.236). The identification of 'hotspots' of mapped values, therefore, does not necessarily reflect the existence of the 'most valuable' places, but may also relate to a complex array of other factors that require careful interpretation from the spatial data collected.

Secondly, as already referenced in Section 3.3, the cross-border focus of the research makes the definition of the public more problematic when articulating a PPGIS methodology for heritage inventorying processes. The geographic location of Derry~Londonderry ensures that those living nearby on the County Donegal side of the border can be categorised as local and proximate. However, what (if any) say should they have in official inventorying processes in a neighbouring jurisdiction? And what (if any) weight should be afforded to their views by public authorities? International charters and conventions (Council of Europe, 2000), the strategic spatial planning policies operating in both jurisdictions on the island of Ireland (DRD and DOEHLG, 2013), and various pertinent conceptualisations of cross-border cooperation deriving from the academic literature (Dolff-Bonekamper, 2010; McClelland, 2016), provide both policy imperatives and philosophical justification in support of the involvement of a cross-border public in such cultural heritage management processes. Nonetheless, other factors can make this more difficult to achieve in practice. A distinct scale dimension is pertinent when considering heritage, particularly as 'scale itself is a potent source of heritage dissonance' (Graham *et al.*, 2000, p.181). For instance, the principal heritage inventorying and designation processes considered in WP1 in most cases take place at the 'national' scale, and it is at this level that heritage has traditionally been legislated for, defined, and protected via national heritage agencies.

A third issue is arguably more straightforward to resolve and concerns when the public should be engaged in heritage inventorying processes. In short, following the framework propagated by Rowe and Fewer (2000) to assist in evaluating the success of public participation processes, as applied by Kahila-Tani *et al.* (2016), participation should occur at the earliest opportunity. In the case of the Helsinki master plan, preparation of the PPGIS tool and participation and evaluation plan occurred at the beginning of the process (Kahila-Tani *et al.*, 2016). When considering the 'listing process' flowchart guiding the HED in Northern Ireland, as illustrated in Appendix 1, public participation in an area-based inventorying process would be initiated soon after the start of the survey and before the detailed 'expert' inputs are commissioned. The use of PPGIS and other digital tools requires significant time and the dedication of other resources. For example, as Minner *et al.* (2015, p.36) emphasise, the successful implementation of Austin's Wiki required a 'willingness among government officials to engage with the public and a long-term commitment to both citizen participation and

stewardship of online resources'. Developing an online PPGIS infrastructure is one necessary component in its wider rollout, as is making room for public participation in inventorying survey timetables, but the logic of online methods is that they ultimately facilitate interactivity, meaning that public engagement becomes a recurring process and constant communication flow rather than a one-off event. However, as Fredheim (2016, p.116) underlines, 'digital participatory projects are often more expensive than traditional approaches due to high design costs and continuous need for maintenance and updates'.

5.0 POTENTIAL CASES

This section aims to set out the aspirations and constraints governing the methodological choices elaborated later, with emphasis on the selection of cases for the fieldwork stages of the research. Secondly, potential cases are listed and some of their key characteristics referenced as an aide to decision-making over case selection in Section 7.0.

5.1 Aspirations and constraints

The methodological choices in advance of the fieldwork stages of the project are guided by certain aspirations and constraints. Firstly, from an aspirational point of view, the REINVENT Project offers the prospectus to explore multiple PPGIS-methods, thereby suggesting the selection of a combination of internet based and face-to-face engagement techniques purposively targeted at differentially-defined communities in the North West. To reiterate what was stated in Section 3.1, the objective at this stage of the project is not to determine the ‘best’ methodology, but rather to propose the testing of several methods (and digital tools) with a view to achieving methodological learning over the course of the fieldwork. Secondly, the project facilitates the consideration of multiple cases at different spatial scales in the cross-border cultural landscape of Derry~Londonderry. Indeed, the four distinct categories of heritage indicated in WP1 when considering the official heritage inventories on the island of Ireland represent (three) different spatial scales, ranging from individual buildings and monuments to more geographically extensive areas and cultural landscapes. These are not mutually exclusive categories, of course, and significant blurring undoubtedly occurs in instances such as the Derry~Londonderry city walls, a scheduled monument in State Care encircling much of the Historic City Conservation Area and encompassing numerous listed buildings and other designated heritage resources. The overall aspiration, however, is to investigate at least three cases in the fieldwork stages of the project, which would ensure that each of the heritage categories and spatial scales are represented.

Several constraints also influence the methodological choices, including the timeframe for completion of the fieldwork, the resources available for this purpose, and the skills and capacity of the researcher to successfully complete the diverse tasks. For instance, 10 months (May 2017 – February 2018) is earmarked in the REINVENT Project work plan for the fieldwork in the North West, with the subsequent 5 months set aside for the mapping and analysis of the collated data. Consequently, the number and scope of the selected cases cannot be overly complex to ensure completion within this period, including the transcription and mapping of participant generated outputs. Secondly, as the resources available are

limited, the financing of a targeted survey mailshot to numerous people in the North West in pursuit of a statistically representative sampling strategy appears unjustifiable when considered against the relatively low success rate determined from the peer-reviewed literature. Thirdly, the researcher's skills and capacity are pertinent when considering the achievability of the methodology given the training-through-research ethos of Marie Skłodowska-Curie Actions (MSCA) Individual Fellowships. The necessity to quickly acquire (PP)GIS skills at an early stage of the project presents a significant challenge for the researcher and pre-existing limitations in technological knowledge inevitably serve as a restraint on the ambitions of the research.

5.2 Case selection

A range of possible cases are indicated in Figure 7, which outlines the heritage category (as derived from the classifications utilised in WP1, and taken to denote scale), the existence of any official heritage designations, and the key characteristics of the case area/building/monument/landscape. The identification of these cases as being of potential interest is derived from the academic and policy literature, local knowledge of the North West, and initial thoughts generated from the first meeting of the Consultative Group. It is recognised that a significant number of buildings and monuments could be considered for selection, and that on a handful of cases are referenced in the table. However, these are arguably the most prominent in terms of their symbolic importance to Derry~Londonderry, are subject to ongoing negotiation over their meaning and ascribed values, and several of which have undergone/or will undergo regeneration in the recent past/near future. In addition to those pre-defined cases in Figure 7, an ideal opportunity exists for prospective participants to identify and inventorise their own heritage resources.

This is particularly relevant in relation to younger people, as demonstrated by award-winning research projects such as the UK Arts and Humanities Research Council-funded 'You Can't Move History. You Can Secure The Future', which investigated young people's attachment to subcultural spaces – focused on the undercroft on London's South bank.³ The imperative for heritage professionals to engage with young people in cultural heritage matters is underlined by Ripp and Rodwell (2016, p.100) who identify 'youths with poor educational qualifications in post-industrial urban communities' and school children as being 'amongst the least considered at present'. Such an approach, amongst other things, would also significantly enhance the co-

³ See <http://www.ahrc.ac.uk/research/readwatchlisten/features/research-in-film-award-winners-you-can-t-move-history>.

creation potential of the research while continuing to facilitate the testing of different digital mapping methods and tools. Moreover, official heritage organisations are increasingly asking the public to identify what places and buildings they care about and why. For instance, Historic Environment Scotland recently launched their 'What's Your Heritage?' initiative under the umbrella of Scotland's Year of History, Heritage and Archaeology in 2017.⁴ In 2009, according to Valestrand (2015, p.82), the Norwegian Directorate for Cultural Heritage granted 12 'everyday' sites Special Protection Orders as part of their contribution to the Norwegian 2009 Cultural Year, including a bus shelter in the north of the country that few would consider 'an aesthetic beauty', indicating that 'heritage from below' processes are leading to certain shifts in official designatory practices.

⁴ See <https://www.historicenvironment.scot/advice-and-support/listing-scheduling-and-designations/what-s-your-heritage>.

Figure 7: Potential fieldwork cases in the North West

CASE	CATEGORY	DESIGNATIONS	KEY CHARACTERISTICS
Historic City Conservation Area	Area	Conservation area; listed buildings; scheduled monuments (plus State Care); undesignated structures	Large mixed use area, comprising much of city centre, in multiple-ownership with commercial, residential, hotel & cultural/institutional functions predominating. Several important public spaces & ecclesiastical buildings
Magee Conservation Area	Area	Conservation area; listed buildings; undesignated structures	Mixed use area, on edge of the city centre, in multiple-ownership with Ulster University Magee campus functionally dominant, & other educational, cultural/institutional, & residential terraces also evident
Clarendon Street Conservation Area	Area	Conservation area; listed buildings; undesignated structures	Mixed use area, on edge of the city centre, in multiple-ownership with office & residential functions predominating & some cultural/institutional buildings
Ebrington Barracks	Area	Listed buildings; scheduled monuments; undesignated structures	Large mixed use development in the Waterside district, owned by government, in prominent position now connected to cityside with Peace Bridge. Former British army base & largest regeneration site in city
Guildhall	Building	Listed building; in conservation area	Most prominent institutional and civic building in the city linked to important public space & opposite city walls
City Walls	Monument	Scheduled monument (State Care); in conservation area	Seventeenth century walled circuit & most well-known heritage resource in the city
Diamond War Memorial	Building	Listed building; in conservation area	Key focal point in city centre & subject of certain contestation over its ascribed meanings and values
Waterside Railway Terminus	Building	Listed building	Historic railway station in the Waterside district proposed for new transport hub in the city
'Your heritage'	Building / Monument	Designated or undesignated	Heritage defined by public
Brooke Park	Landscape	Registered Historic Park, Garden, Demesne; listed buildings	Important and historic public space on city side recently subject of a regeneration project
Cultural landscape	Landscape	Multiple designations	Undefined, undelineated, cross-border historic urban landscape

6.0 PPGIS/DIGITAL MAPPING TOOLS

Most of the peer-reviewed articles evaluated during this literature review do not provide details or a web link for the PPGIS/digital mapping tools developed in relation to the various research projects, although the website of the Landscape Values & PPGIS Institute elaborates the results and provides mapped visualisations from numerous PPGIS studies undertaken by Institute members and their collaborators. However, those tools that are referenced and available to interrogate online are indicated on Figure 8 (overleaf), including several that are free and open source to use. The table lists the tool names, provides the literature reference and web link from which information was obtained, indicates the key focus of each of the tools, determines whether they are free and open source (FOSS) (and under what conditions they may be used/adapted), and outlines whether they may be adaptable for the purposes of the REINVENT Project. A range of other commercial and open-source web-based PPGIS applications that are not indicated in Figure 8 are referenced by Babelon *et al.* (2016), including *CommonPlace*, *Mapping for Change*, *Carticipe* and *coUrbanize*. The functionality of these tools is not discussed, and nor are examples of their use provided, although various cases are indicated on the respective websites of each of the tools. Nonetheless, they illustrate the diverse and growing number of PPGIS and participatory mapping applications available to purchase from both commercial organisations and academic institutions.

For the purposes of the REINVENT Project the Arches software is deemed a desirable platform from which to develop the mapping tool in advance of the fieldwork for several compelling reasons:

- The software is free, open source, customisable and specifically focused on cultural heritage management – the proposed new Arches version 4 will be released on 24 March 2017 and will incorporate new and improved capabilities including mobile data collection;
- Arches is already used by official heritage agencies in US and elsewhere and is being trialled by Historic England on their Greater London Historic Environment Record as well as the City of Lincoln's management of their cultural heritage data;
- Its creation by respected conservation organisations and credible track record of use means more likely to be accepted by local heritage agencies on the island of Ireland and its adaptation for the purposes of the REINVENT Project will also be followed by the 'Arches community' worldwide, thereby helping in the future dissemination of the methodological learning from the project; and
- The researcher secured a place on a two-day workshop at Liverpool John Moores University (29-30 March 2017) organised by the Getty Conservation Institute at which the

Arches v4 will be introduced. The opportunity exists for ongoing dialogue with the Institute and the software designers as Arches is adapted for the REINVENT Project.

Figure 8: PPGIS / digital mapping tools identified from the peer-reviewed literature and their adaptability for the purposes of the REINVENT Project

MAPPING TOOL	LITERATURE REFERENCE / WEBLINK	KEY FOCUS	FREE AND OPEN SOURCE	ADAPTABILITY
Map-Me (Spraycan)	Huck <i>et al.</i> , 2014 Click here	Provides 'airbrush' interface without enforcing precise mapped boundaries	Yes, with acknowledgement to creators – registration required	Adaptable to range of subject-matters & places
Maptionnaire	Kahila-Tani <i>et al.</i> , 2016 Click here	Creates map-based questionnaires & civic participation platforms	No, charges apply	Adaptable to range of subject-matters & places Customisable & data exportable to other GIS software
Austin Historical Survey Wiki	Minner <i>et al.</i> , 2015 Click here	Facilitates public participation in inventorying of heritage in Austin	No, although software available elsewhere to create bespoke Wikis	Applicable to augmenting Austin survey Tool & inventory attributes adaptable elsewhere
SurveyLA	Bernstein and Hansen, 2016 Click here	Facilitates public participation in inventorying of heritage in Los Angeles	No, although utilises Arches software (see below)	Applicable to augmenting Los Angeles survey Tool & inventory attributes adaptable elsewhere
Hot-Spot-Monitor	de Vries <i>et al.</i> , 2013 Click here	Measures the attractiveness of places	Yes, providing data fed into central database – registration required	Applicable to range of places but adaptability to other subject-matters limited
Arches	Myers <i>et al.</i> , 2016 Click here	Software platform for heritage inventorying & management	Yes	Adaptable to heritage inventorying elsewhere Customisable & data exportable to other GIS software Inventory attributes adaptable elsewhere

The developed mapping tool will necessarily incorporate several sections pertinent to the university ethical approval process, the collection of socio-economic data from participants (anonymised), and will also questions to facilitate cross-case (scale) comparisons in the subsequent analysis. Furthermore, the tool will be designed in pursuit of the privacy-by-design principles as stipulated in the REINVENT Project Grant Agreement, which promotes privacy and data protection compliance from the initiation of the project and throughout its entire lifecycle.

7.0 PROPOSED METHODOLOGY

The proposed methodology for the fieldwork stages of the REINVENT Project is outlined in Figure 9, which also indicates the three cases selected (relating them to the heritage categories and scales previously discussed), and the various dimensions of the cases including the suggested attributes to be mapped, by whom and associated methods. The names and key focal points of the proposed cases is elaborated over the following sections.

Figure 9: Proposed fieldwork methodology and cases

Dimensions	HERITAGE CATEGORY / SCALE		
	<i>Landscape</i>	<i>Area</i>	<i>Building / Monument</i>
<i>Case</i>	Cross-border cultural landscape of Derry~Londonderry – North West Landscape Values Assessment	Ebrington Barracks – Ebrington Sense of Place Values	Participants define own heritage – Your Heritage North West
<i>Location</i>	North West (largely confined to Derry City & Strabane District Council & Donegal County Council areas)	Delineated district within Derry~Londonderry	Derry City & Strabane District Council & Donegal County Council areas
<i>Attributes mapped</i>	Landscape values / special places	Sense of place values / attributes / development preferences	Heritage values / attributes
<i>By whom</i>	Public	Site users / tourists-visitors / residents	College students (18+)
<i>When</i>	August 2017 – October 2018	May 2017 – February 2018	September 2017 – February 2018
<i>Methods</i>	Internet mapping / information sessions	Walking (& sedentary) semi-structured interviews / internet mapping	Workshops / internet mapping

7.1 North West Landscape Values Assessment

It is proposed that this case will consist of an internet mapping exercise open to the public focused on identifying special places and landscape values in the North West. Associated information sessions explaining the purpose and how to complete the exercise will be held during Heritage Week (in County Donegal), European Heritage Open Days (in the Derry City & Strabane District Council area) and Culture Night (in both council areas), while a diverse

range of groups will also be targeted in relation to organising bespoke information sessions. The exercise will be promoted through the network of organisations represented on the consultative group, social media and in the local press in addition to flyers/posters distributed in various locations in the North West.

7.2 Ebrington Sense of Place Values

This case will entail a mixture of walking interviews and internet mapping methods in seeking multiple-stakeholder viewpoints on sense of place values and development preferences within the Ebrington regeneration area in Derry~Londonderry (see www.yourebrington.com). The targeted public (up to 10 people from each of the delineated groups) will include site users (i.e. businesses/organisers located in the area), tourists/visitors, and nearby residents, who will be randomly recruited through multiple means, including on-site, at the Visit Derry tourist information office, and through local community networks. Walking interviews will be voice recorded (with sedentary interviews also available for those unable to walk for age, health and other reasons) and GPS tracked to allow for later mapping, while participants will also undertake a secondary internet mapping exercise following the walk. This two-pronged approach will allow comparison between methods.

7.3 Your Heritage North West

This case will seek to engage young people from two local colleges (the Northern Regional College in Derry~Londonderry and Letterkenny Institute of Technology in County Donegal will be approached with a view to a class from each participating) in defining places of cultural significance for each of them. Workshops will be held in the respective colleges to explain the project and the technicalities of using the mapping tool. The students will then research and document a building/monument/place in their own time using mobile and other devices with the downloaded (and customised) Arches software. A final workshop will then facilitate a discussion of the heritage resources that they identified and the usability/functionality of the mapping tool etc.

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USEFUL WEBSITES

Arches: www.archesproject.org

Austin Historical Wiki: <http://beta.austinhistoricalsurvey.org>

Carticipe: <https://carticipe.net>

coUrbanize: <http://courbanize.com>

CommonPlace: <http://www.commonplace.is>

Ebrington: www.yourebrington.com

HistoricPlacesLA: <http://historicplacesla.org>

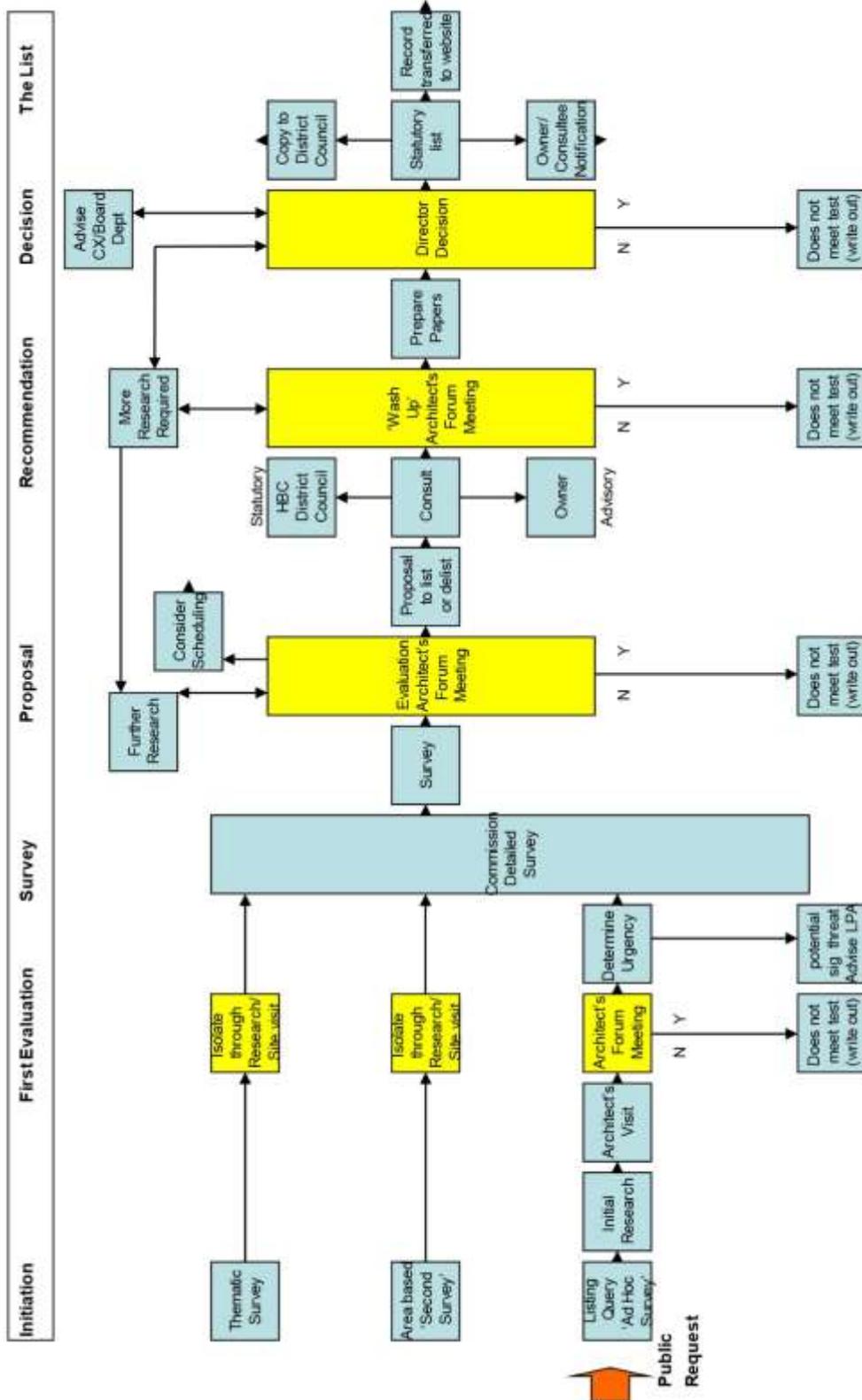
Landscape Values & PPGIS Institute: <http://www.landscapemap2.org>

Mapping for Change: <http://mappingforchange.org.uk>

Maptionnaire: <https://maptionnaire.com>

APPENDIX 1

The Historic Environment Division's 'listing process' flowchart as of August 2015



APPENDIX 2

A selection of heritage value typologies as identified by Fredheim and Khalaf (2016, p.468)

Riegl ([1902], 1982) Age Historical Commemorative Use Newness	Australia ICOMOS (1979) Aesthetic Historic Scientific Social	Lipe (1984) Economic Aesthetic Associative/Symbolic Informational	Darvill (1995) Use Archaeological Research Scientific Research Creative Arts Education Recreation and Tourism Symbolic Representation Legitimation of Action Social Solidarity and Integration Monetary & Economic Gain Option Stability Mystery & Enigma <i>Existence</i> Cultural Identity Resistance to Change Throsby (2001) Aesthetic Spiritual Social Historical Symbolic Authenticity	Carver (1996) Market Capital/Estate Production Commercial Residential Community Amenity Political Minority/Disadvantaged/ Descendant Local Style Human Environmental Archaeological
Frey (1997) Monetary Option Existence Bequest Prestige Educational	Ashley-Smith ((1999) Economic Informational Cultural Emotional Existence	Pye (2001) Historic Artistic Scientific Cultural Contextual Condition Economic	English Heritage (2008) Evidential Historical Aesthetic Communal	Mason (2002) Historical Cultural/Symbolic Social Spiritual/Religious Aesthetic Market Existence Option Bequest Orbaşlı (2008) Age and Rarity Architectural Artistic Associative Cultural Economic Educational Emotional Historic
Feilden (2003) Emotional Wonder Identity Continuity Spiritual & Symbolic Cultural Documentary Historic Archaeological, Age & Scarcity Aesthetic & Symbolic Architectural Townscape, Landscape & Ecological Technological & Scientific Use Functional Economic Social Educational Political & Ethnic Stubbs (2009)	Keene (2005) Social Aesthetic Spiritual Historical Symbolic Authenticity	Appelbaum (2007) Art Aesthetic Historical Use Research Educational Age Newness Sentimental Monetary Associative Commemorative Rarity	ICOMOS New Zealand (2010) Aesthetic Archaeological Architectural	Landscape Local Distinctiveness Political Public Religious & Spiritual Scientific/Research/ Knowledge Social Symbolic Technical Townscape Lertcharnrit (2010)
Universal Associative Curiosity Artistic Exemplary Intangible Use	Gómez Robles (2010) Typological Structural Constructional Functional Aesthetic Architectural Historical Symbolic	Szmelter (2010) Cultural Identity, Emotive Artistic/Technical, Evidence Rarity, Administrative Contemporary Socio-Economic Economic, Resource Functional, Usefulness Educational, Tourism Social, Awareness Political, Regime	Commemorative Functional Historical Landscape Monumental Scientific Social Spiritual Symbolic Technological Traditional	Informational Educational Symbolic Economic Entertaining/Recreational