An Investigation into the role of PPGIS in Irish Local Government

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

Signed: _____

Kieran Duane

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Abstract

A Geographic Information System (GIS) that is publically available on the Internet, providing access to spatial data and GIS utilities, offers a different and potentially important means to assist public participation in the planning and decision making process. The Irish government is actively pursuing a policy of eGovernment which calls for the use of technology to encourage engagement with citizens. The extent to which Public Participation Geographic Information System (PPGIS) is used to accomplish this goal is unclear. This dissertation aims to establish; the current extent to which PPGIS is used in Irish local government, if there is a demand to extend the use of PPGIS and what are the barriers to the utilisation of PPGIS. A review of local authority websites, a survey of GIS Officers and staff and interviews with a subset of the survey respondents were used to gather both quantitative and qualitative data. An analysis of secondary data from the "fixyourstreets.ie" web application was completed to measure the level of public support for an implementation of PPGIS. It was found that the current use of PPGIS in Irish local government is minimal in spite of the fact that it is a goal of the Irish government to increase the involvement of local communities in decision making. There is support amongst local authority GIS Officers and staff to increase the use of PPGIS but they need the support of senior management to make it a success. In addition to this the "fixyourstreet.ie" data analysis indicates that the public are supportive of the system. Finally, the primary barriers to the adoption of PPGIS in Irish local government identified were; lack of leadership, concerns about data quality, i.e. non-expert data entered by the public, culture change and lack of available resources.

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Abbreviations

PP	Public Participation
GIS	Geographic Information System
PPGIS	Public Participation Geographic Information System
PGIS	Participatory Geographic Information System
LA	Local Authority
LGMA	Local Government Management Agency
HIS	Head of Information Systems
DECLG	Department of the Environment, Community and Local Government
ACEO	Assistant Chief Executive Officer
CEO	Chief Executive Officer
ICT	Information Communications Technology
DCENR	Department of Communications, Energy and Natural Resources
SDI	Spatial Data Infrastructure
LGCSB	Local Government Computer Services Board
PMHL	Postcode Management Licence Holder
NCGIA	National Center for Geographic Information and Analysis
USA	United States of America
IR	Implementing Rules
SCI	Statement of Community involvement
SEA	Strategic Environmental Assessment
EIA	Environmental Impact Statement
EIS	Environmental Impact Statement
VGI	Volunteered Geographic Information
IS	Information System
API	Application Programming Interface
INSPIRE	Infrastructure for Spatial Information in Europe
CCMA	County and City Management Association
NPPR	Non-Principal Primary Residence
ESRI	Environmental Systems Research Institute

OS*i*	Ordinance Survey Ireland
NGO	Non-Governmental Organisation

1 Introduction

It is estimated that 85% of government data contains spatial components and can therefore be mapped using a Geographic Information System (GIS) (Gonzalez et al., 2009). The term “Public Participation Geographic Information System (PPGIS)” refers to a field of GIS that seeks to enhance public participation and foster the empowerment of non-governmental organisations (NGOs), grassroots groups and local communities (Brown et al., 2013, Tsai et al., 2013, Corbett, 2003). Unlike GIS, which is used within an organisation for analytic and decision making processes, PPGIS transcends the boundaries of an organisation to involve citizens in collaborative mapping exercises and provides them with the use of GIS for personal or collaborative decision making processes.

This research is an investigation of the role, both current and potential, of PPGIS in Irish local government. The advantages and disadvantages of PPGIS have been widely documented however, its utilisation within Irish local government is unclear. The aims of this research are to establish the extent of the use of PPGIS in Irish local government to date, to establish if there is a demand within Irish local government to extend the role of PPGIS and to identify the existing barriers to the utilisation of PPGIS in Irish local government.

Local government has a major role to play in the operation of the country. It is an essential element of the democratic process. Local councillors are elected, therefore the role of local government is both representational and operational, with responsibility for a wide variety of public services which include:

- Agriculture, education, health and welfare
- Environmental protection
- Housing and building
- Libraries
- Roads and transport
- Planning and development
- Recreation and amenity
- Sanitation services
- Waste
- Water and sewerage
- Miscellaneous services, e.g. Maintenance of the Register of Electors.

Local authority (LA) activities impact on districts and the daily lives of the people that live within their boundaries, both economically and socially. One of the challenges facing LAs is the need to encourage development while protecting the environment. Unlike other areas of public administration, LAs work in close proximity to local communities.

In the Local Government and the Elected Member Booklet (DECLG, 2004), the representational duty of local government is described as:

"It operates through a network of directly elected local authorities which provide, among other things, a forum for the democratic representation of local communities, giving expression to local identity, identifying local concerns and setting local priorities."

Since the economic collapse in September 2008, LAs have seen their budgets and staff numbers significantly reduced which left many of them struggling to maintain the pre-collapse level of public services. In October 2012 the government published "Putting People First Action Programme for Effective Local Government" which sets out government policy for radical reforms across the primary areas of local government. Under the Action Programme all 80 existing town councils have been replaced by a system of municipal districts which integrate town and county governance. The following LAs have been amalgamated:

- Limerick City Council and Limerick County Council
- Tipperary North County Council and Tipperary South County Council
- Waterford City Council and Waterford County Council

Following the amalgamation, there are now 31 city and county councils with integrated municipal districts. These reforms were brought into effect from the 1st June 2014. Due to the fact that these changes were implemented during the course of this research it was decided to base the study on 31 city and county councils.

In the Action Programme (DECLG, 2012b, p12) it is stated that,

"Mechanisms to promote greater community/citizen engagement with local government will be considered, including possible participative democracy arrangements."

Government are committed to increasing public participation with the aim of addressing local concerns and setting local priorities which is interesting because this suggests that PPGIS has a strategic role to play in Irish local government. This means that this research will be of significance to all LAs, the Department of the Environment, Community and Local Government (DECLG) and the public.

1.1 Background

Due to the nature of PPGIS it is important to understand the factors that could influence its adoption. In the following section, the financial health of LAs, digital Ireland (Internet usage, computer literacy, eGovernment policy and public usage of eGovernment services) and the INSPIRE directive are discussed.

1.1.1 Local Authorities Financial Situation

Irish local government is currently under considerable financial strain. The Local Government Audit Service Activity Report (DECLG, 2014b) which examines the spending for 2012, the last year for which figures are available, highlights the *"deteriorating financial position" (DECLG, 2014b, Pg 7))* of a number of county councils. It states that of the 34 LAs, 20 are essentially insolvent, relying on overdrafts and bank borrowings to meet daily expenses. In Sligo County Council the situation is so bad that the focus is on maintaining services at a level to ensure compliance and statutory obligations while essentially eliminating discretionary spending. The report warns that the radical process of reform laid out in DECLG (2012a) will present major challenges for the sector.

Some of the concerns raised in the report include a failure to go to market to obtain the most competitive price for services and the indebtedness of councils, which owe some €2.3 billion. There are also the mortgages that were secured through the LAs which total €1.3 billion and have mounting arrears. According to the DECLG the overall spend in councils has considerably reduced since 2008 as the level of funding available from central government has been reduced. Staff numbers have dropped by 26% from 37,243 in June 2008 to 27,456 in December 2013, with significant cuts in payroll which include staff overtime and allowances (DECLG, 2014a).

1.1.2 Digital Ireland

Internet usage

For PPGIS to be a success it is essential that people can access it and have the necessary skills and desire to use it. According to the Internet activity and digital skills in Ireland - 2013 Report (European Commission, 2013b), 74% of the Irish population use the internet regularly. Regular Internet usage is defined as at least once a week. This figure is up from 71% in 2011 and higher than the EU average of 70%. This means that Ireland is approaching high internet usage. Daily users of the Internet now account for 58% of the population which is an increase of 3% since 2011 and higher than the EU average of 59%. The percentage of people who have never used the Internet has decreased by 3% since last year to 18% which is below the EU average of 22%. In terms of disadvantaged

people, the percentage of regular internet usage is 59%, higher than the EU average of 54%.

Data on mobile use of the Internet indicates that 51% of individuals in Ireland accessed the Internet via a mobile device in 2012, significantly higher than the EU average of 36%. In terms of enterprises in Ireland, 50% of them provide their staff with portable devices to access the Internet, slightly above the EU average of 48%.

The report also shows that 63% of individuals go online in order to find information about goods and services, which slightly exceeds the EU average of 62% and is a significant increase on 2012 when the rate was 53%. See figures 1.1 and 1.2 for graphical representations of the figures detailed above.

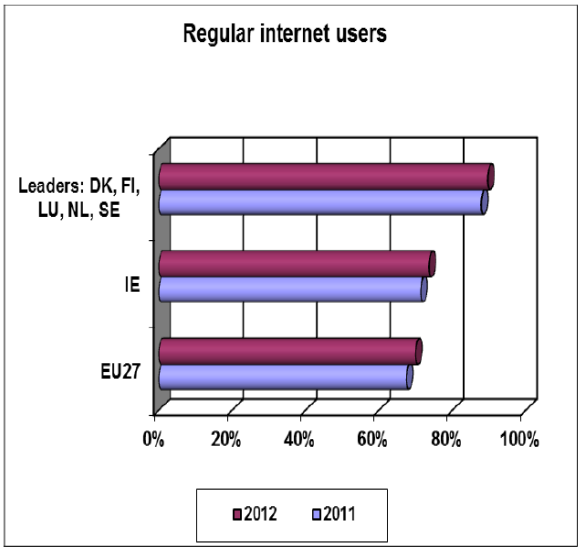


Figure 1.1: % of regular Internet users (European Commission, 2013b)

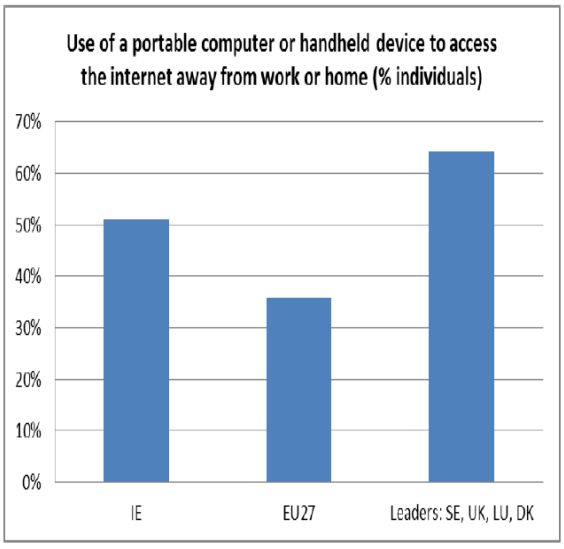


Figure 1.2: % of mobile Internet users (European Commission, 2013b)

Computer skills

European Commission (2013b) reports that when compared with the rest of Europe in terms of basic computer skills, Ireland shows average rates and the progress is sluggish in relation to highly skilled individuals.

65% of the population in Ireland have some level of computer skills which is slightly below the average of 67% for the EU. In 2012, 31% of the population of Ireland had high computer skills which is an increase of 5% on 2011 and higher than the EU average of 26%. While Ireland is exceeding the EU average there is a significant gap from the more advanced Nordic countries. The report notes that a significant effort is required for Ireland to match these rates of people with high digital skills.

In Ireland it is more likely that people will have low or medium ICT skills than high skills. This could in part be blamed on the building boom when construction related courses were more popular than science and technology. It would be expected that this will change now that the knowledge economy is being promoted as part of the programme for government and due to the fact that Ireland has become a "Tech hub".

People with medium computer skills represent 23% of the population which is higher than the EU average and having decreased by 2% since 2011. The assumption is that this percentage of the population has moved into the highly skilled bracket. Significantly, 11% of citizens have low computer skills which is below the EU average of 16%. This rate remains practically unchanged since 2011. See figure 1.3 for a graphical representation of the figures detailed above.

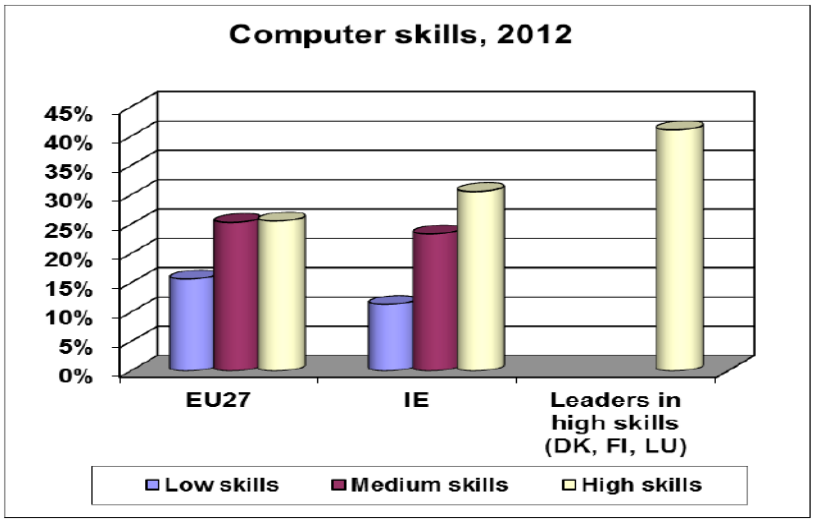


Figure 1.3: Irish Computer Skills Compared with the EU (European Commission, 2013b)

e-Government

"Improved decision-making is perhaps the most promising element in e-government" (Hansen and Prosperi, 2005).

In April 2012 Brendan Howlin, Minister for Public Expenditure and Reform published the eGovernment Strategy 2012 – 2015 (DPER, 2012, p1 & p5), for Ireland. The strategy highlights the fact that *"citizens and businesses expect public services to be delivered faster, better and more efficiently than in the past"* and identifies *"intelligent, targeted use of Information and Communications Technology (ICT) and eGovernment"* as key enablers. While the strategy does not specifically call for the use of GIS for two way communication with the public it does state that *"improvements or streamlining in internal processes"* should be achieved through changes to *"procedures"*, *"processes"* and

"channels used". This suggests that if there was support for PPGIS in Irish local government, it would receive the necessary backing from central government.

The eGovernment strategy states that, *"Public Bodies will seek to extract maximum benefit from Post Codes when these are introduced."* (DPER, 2012, p8). It has been announced by the Department of Communications, Energy and Natural Resources (DCENR) that every address in the country will be allocated a post code by 2015 (DCENR, 2013). The implementation of the post code system will require that all of Ireland's non-unique addresses will have to be assigned a post code. PPGIS has the potential to simplify this process by enabling those citizens with non-unique addresses to identify their property on a GIS map thus enabling the allocation of a post code with minimum effort on the part of the allocating authority (Postcode Management Licence Holder (PMHL)).

By implementing the ICT aspects of the Programme for Government and the Reform Plan the focus is on the customer and improving and extending the use of technology in innovative ways to enhance the customer's experience of interacting with government. Figure 1.4 is taken from the eGovernment in Ireland 2013 Report and provides the score for each Top Level Benchmark comparing Ireland with the EU-27+. EU27+ is comprised of the EU27 countries plus Croatia, Iceland, Norway, Switzerland and Turkey. Ireland compares well to the EU 27+ with the exception of "Key Enablers", which would include broadband, etc..

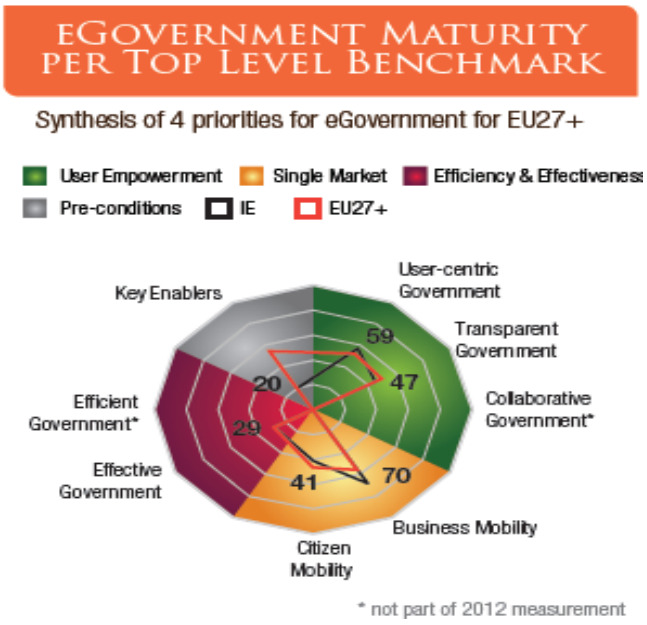


Figure 1.4: eGovernment Maturity per Top Level Benchmark (European Commission, 2013a)

The Internet activity and digital skills in Ireland - 2013 Report (European Commission, 2013b) states that in 2012, 49% of the Irish population utilised the Internet for eGovernment services, an increase of 5% on 2011. In terms of the EU, the rates are higher than the averages of 44% and 22% respectively. See figure 1.5 for a graphical representation of Ireland's position relative to the other EU members.

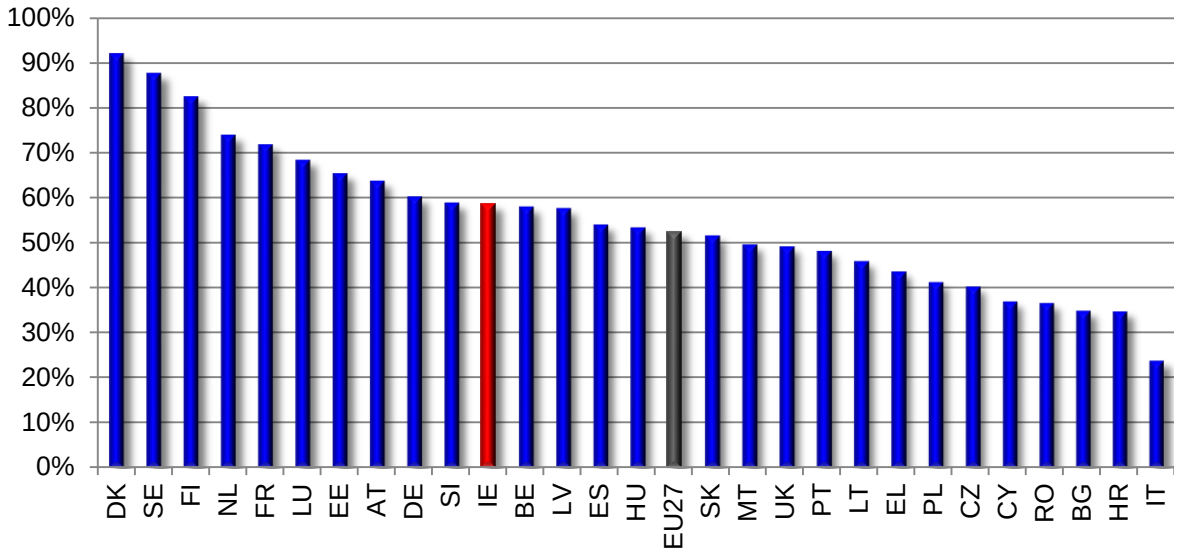


Figure 1.5: Proportion of citizens using the internet to interact with public authorities (2012) (European Commission, 2013b)

Another important fact is that 91% of enterprises in Ireland are using the Internet to interact with public agencies which is higher than the EU average of 87%. Clearly there is a significant proportion of the population of Ireland not using the eGovernment services. Table 1.1 details some of the reasons why.

Table 1.1: Reasons for not using eGovernment Services in Ireland (European Commission, 2013a)

Reasons for not using eGovernment services in Ireland	
Not aware of existence relevant websites/online services	26%
Preferred to have personal contact	56%
Expected to have things done more easily by other channels	19%
Concerns about protection and security of personal data	10%
No skills/knowledge to get what I wanted/needed via the Internet	1%
Could not find or access the information or services	19%
Services will require personal visits/paper submission anyway	33%
Abandoned the service because too difficult to use	5%
Abandoned the service because of technical failures	3%
Did not expect to save time by using the Internet	10%
Other reasons	10%

1.1.3 INSPIRE

On 15th May 2007 the INSPIRE (Infrastructure for Spatial Information in Europe) Directive was entered into force which establishes an infrastructure for spatial information to support community environmental policies and policies or activities which may have an impact on the environment. The basis for INSPIRE is in the infrastructures for spatial information established and operated by the 27 member states of the European Union. To guarantee that the spatial data infrastructures of the member states are compatible and usable in a community and cross border situation, the Directive stipulates that common "Implementing Rules" are instigated in a number of particular areas:

- Metadata
- Data Specifications
- Network Services
- Data and Service Sharing
- Monitoring and Reporting

The "Implementing Rules" are adopted as Commission Decisions or Regulations and are compulsory in their entirety (European Commission, 2007). The directive is intended to enable interoperation between nations however, it is a catalyst in Ireland to enable interoperation between LAs. This has long been an issue in Ireland where by bordering councils used differing data standards and technologies prohibited trans-boundary queries or data centralisation. As LAs are now obliged to work towards spatial data standards the difficult but essential exercise cannot be avoided.

In summary, Irish local government faces challenges and opportunities. While 74% of the public are using the Internet regularly, only 49% are utilising it for eGovernment services. More needs to be done to produce and promote quality eGovernment services and help the remaining 26% of the public to get online.

1.2 Dissertation Structure

The dissertation is divided into 5 chapters:

Chapter 1 is an introduction to the research area and includes a synopsis of the subsequent chapters.

Chapter 2 is the review of existing literature and includes the seminal and relevant recent literature in the field of PPGIS. The literature review will be used to establish an understanding of the “public”, “public participation”, GIS and how they all converge to form the concept of PPGIS.

Chapter 3 explores the methodology that was utilised and the methodological approaches that were considered but ultimately discounted. The deductive approach taken to answer the research question is described. A review of LA websites and a self-administered online survey followed by interviews were conducted amongst the GIS Officers and staff of the LAs which provided both quantitative and qualitative primary data for analysis. In addition to this, secondary data from “fixyourstreet.ie” was analysed.

Chapter 4 contains the analysis and interpretation of the survey, interview and secondary data. The analytical methods utilised are laid bare for scrutiny in terms of correctness and rigour. The revelations from the research are revealed.

Chapter 5 discusses the conclusions and reports the findings of the research. It examines how the research advances the state of knowledge and thinking regarding PPGIS in Irish local government and suggests some possibilities for future research.

2 Literature Review

This literature review examines the existing literature with a focus on the use of GIS to enable “Public Participation”. PPGIS will be broken into its constituent parts during the literature review. Examples of PPGIS will be identified and reviewed. The advantages, disadvantages, challenges, benefits and barriers to its adoption will all be discussed.

2.1 Public Participation Geographic information System (PPGIS)

A GIS is a system designed to capture, store, manipulate, analyse, manage and display all types of geographical data and a geoportal is a web portal used to access geographic information and associated geographic services over the Internet. Geoportals are important for effective use of GIS and an essential piece of Spatial Data Infrastructure (SDI). Geoportals have an important role to play in efficient and effective public service delivery (Beaumont et al., 2005). A quote from the Public Service Reform eGovernment Strategy:

“Public bodies will evaluate the potential for exploiting digital mapping and GIS technologies in ways that are affordable, sustainable and of relevance to the customer bases of their services, taking into account the personal or commercial sensitivities of the data.” (DPER, 2012, Pg 8)

GIS have been recognised as an important analytics tool for planning and decision support and have been widely implemented in many public and private organisations in Ireland over the last 20 years. The term PPGIS was conceived in the U.S.A. in 1996, at a meeting of the National Center for Geographic Information and Analysis (NCGIA) to describe how GIS technology can support public participation for a diverse range of purposes (Schroeder, 1996) . PPGIS can be defined as a field of GIS that seeks to enhance public participation and foster the empowerment of NGOs, grassroots groups and local communities (Brown et al., 2013, Tsai et al., 2013, Corbett, 2003).

New forms of participation centred on Web-based technologies including online discussion forums, web surveys and online decision support systems have evolved. Barton et al. (2005) state that systems without a participatory component run the risk of becoming out of date and irrelevant to users. According to Schlossberg and Shuford (2005) PPGIS is emerging as a distinct subset of two previously separate activities: technology-based spatial analysis and participatory democracy however, the technology should be considered a means and not an end for PPGIS. Figure 2.1 illustrates this integration.

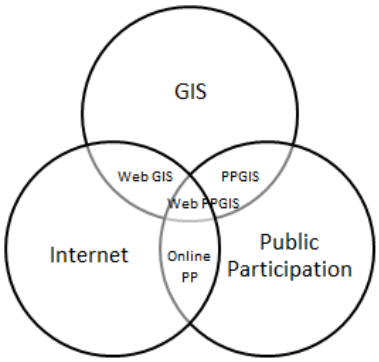


Figure 2.1: GIS, public participation, internet and where they integrate (Tang and Waters, 2005)

The development of new PPGIS technology could be interpreted as a solution to what are considered sub-optimal public participation methods, such as town hall meetings. However, in terms of PPGIS, focusing on the technology and neglecting the process of engaging the public will not achieve the expansive and idealistic purposes that motivated the early PPGIS movement. There is an inherent risk that fixating on the technology will distract from the requisite effort to significantly include the voiceless majority. Effective public participation requires more than innovative technology (Brown and Kyttä, 2014). Implementing PPGIS without a well-defined and justifiable strategy to identify the public, will merely result in existing participatory process issues being transferred to the digital arena. For this reason it is necessary to investigate "public participation".

Public Participation

Irvin and Stansbury (2004) analysed the advantages and disadvantages of Public Participation to both the citizen and to government. Their analysis is summarised in Table 2.1.

Table 2.1: Advantages and Disadvantages of Citizen Participation in Decision Making (Irvin and Stansbury, 2004)

Advantages for the citizen	**Advantages to government**
Education (Learn from and inform government representatives)	Education (learn from and inform citizens)
Persuade and enlighten government	Persuade citizens; build trust and allay anxiety or hostility
Gain skills for activist citizenship	Build strategic alliances
Break gridlock; achieve outcomes	Gain legitimacy of decisions
Gain some control over policy process Outcomes	Break gridlock; achieve outcomes
Better policy and implementation decisions	Avoid litigation costs
	Better policy and implementation decisions
Disadvantages for the citizen	**Disadvantages to government**
Time consuming (possibly boring)	Loss of decision-making control

Pointless if decision is ignored	Possibility of bad decision that is politically impossible to ignore
Worse policy decision if heavily influenced by opposing interest groups	Less budget for implementation of actual projects

Schlossberg and Shuford (2005) highlight the necessity to clearly define the public in "public participation". The public could refer to every citizen in Ireland interested in viewing spatial data online, to the community in an area in which a large scale development is due to take place. It is understood that the public encompasses heterogeneous groups of people, however, examining this heterogeneity in detail is not typically a part of the design and evaluation of participatory systems (Swobodzinski, 2012). Cinderby et al. (2008) state that participants should only be targeted if they are likely to have direct experiential knowledge about the issue in question.

Table 2.2 details the interactions that are possible between a government and its' citizens. It is generally the case that citizens' interaction is type 1 or 2.

Table 2.2: OECD Government to Citizen interaction (Kingston, 2006, Kingston, 2007)

1. Information and transaction Government ⇒ Citizens	Government informs citizens (one way process)
2. Consultation Government ⇄ Citizens	Government consults with citizens (citizen's responses generally predetermined by government via multiple-choice, closed question options)
3. Deliberative Involvement Government ⇄ Citizens	Government engages citizens in consultation process (citizens encouraged to deliberate over issues prior to final response)
4. Government – led active participation Government ⇄ Citizens	Government instigates consultation and retains decision-making powers
5. Citizen-led active participation Government ⇔ Citizens	Citizens are actively engaged in decision-making processes, alongside governments, citizen decisions become binding; citizens share ownership and responsibility over outcomes

Brown et al. (2013) highlight spatial or geographic discounting also known as the NIMBY (Not In My Back Yard) effect. Another form of geographic discounting is BANANA (Build Absolutely Nothing Anywhere Near Anything). It was found that the geographically proximate "public", i.e. those living in the area, were not supportive of land uses favoured

by the geographically detached “public”, i.e. those not living in the area. An example of this in Dublin might be the Incinerator project whereby locals are objecting to the project whereas non-locals are likely to be more supportive of the project. This highlights the potential for difference in local and national interests.

In order to improve the quality of public participation and enable users of PPGIS to suitably characterise, utilise, implement, and evaluate their PPGIS efforts, random sampling of the public is an essential addition to voluntary participation. Local and distant publics must have opportunities to participate. The expansion of the participatory process to involve the majority of stakeholders by means of random sampling is in keeping with PPGIS’s philosophy of public empowerment and is a basic requirement to reforming and improving public participation (Brown et al., 2013). When Internet based GIS is utilised it can potentially move interactions described in Table 2.2 to type 3, 4 and 5.

Traditional versus Technological Participation

Table 2.3 details the various mediums through which public consultation takes place. Two methods traditionally used are meetings/workshops and household surveys.

Table 2.3: Potential methods of Stakeholder Consultation (Kingston, 2006)

Level one (1): education and information provision • Leaflets/brochures • Newsletters • Unstaffed exhibits/displays • Advertising • Local newspapers • National newspapers • Videos • Site visits	Level two (2): information feedback • Staff exhibits /displays • Telephone help lines • Internet • Teleconferencing • Public meetings • Surveys, interviews and questionnaires • Deliberative polls
Level three (3): involvement and consultation • Workshops • Focus groups/forums • Open-house • Open-house (on the internet)	Level four (4): extended involvement • Community advisory committees/liaison groups • Planning for real • Citizen’s juries • Consensus conference visioning • Visioning on the internet

Pocewicz et al. (2012) carried out a comparison between Internet and paper-based PPGIS. It was found that the response rate on paper was 2.5 times that of the Internet response rate and the paper participants mapped more places than the Internet participants. The Internet participants were younger, more likely to have had a degree and lived in the region for less time which might partially explain the lower mapping rates. Another theory for the poor mapping return of the Internet participants was that they may have had difficulties using the mapping utility and abandoned the session after their attempt was unsuccessful.

Kingston (2006; 2007) identifies two views of GIS; GIS as an expensive elitist technology that will lead to exploitation and the opposing view that GIS is a powerful tool for opportunity, communication, democracy and empowering communities rather than an invasive technology that benefits some citizens and organisations and marginalises others. They also suggest that more traditional means of participation are equally restrictive. Public meetings can be intimidating and daunting places resulting in a lot of residents keeping silent. Meetings can be slow and time consuming and due to work and family pressures residents may not be able to attend. A PPGIS has the potential to resolve some of these issues.

It is clear from the literature that web-based PPGIS will not be able to replace traditional methods immediately. However, it can increase the bounds of participation. (Brown and Weber, 2011) state that traditional methods of public participation should still take place. Regardless of the participatory methods chosen it is important to note that,

"…much current participatory practice still relies heavily upon the skills and commitment of the participants to ensure the process and outcomes are effective. Participation often involves the sorts of interactive meetings which can be alien and intimidating to people unaccustomed to such environments." ((Kingston, 2006, Pg 7) quoting (Involve, 2005, Pg 25))

Participation issues in Ireland

A survey carried out by Prendergast and Rybaczuk (2005), highlighted a historical lack of public participation in the forward planning process in Ireland. LAs need to encourage participation. Prendergast and Rybaczuk (2005) point out that the words "public participation" do not appear in planning legislation but rather "public consultation". On the ladder of citizen participation (Figure 2.2), consultation is categorised as a degree of tokenism because the citizen is not guaranteed any kind of real input in the decision.

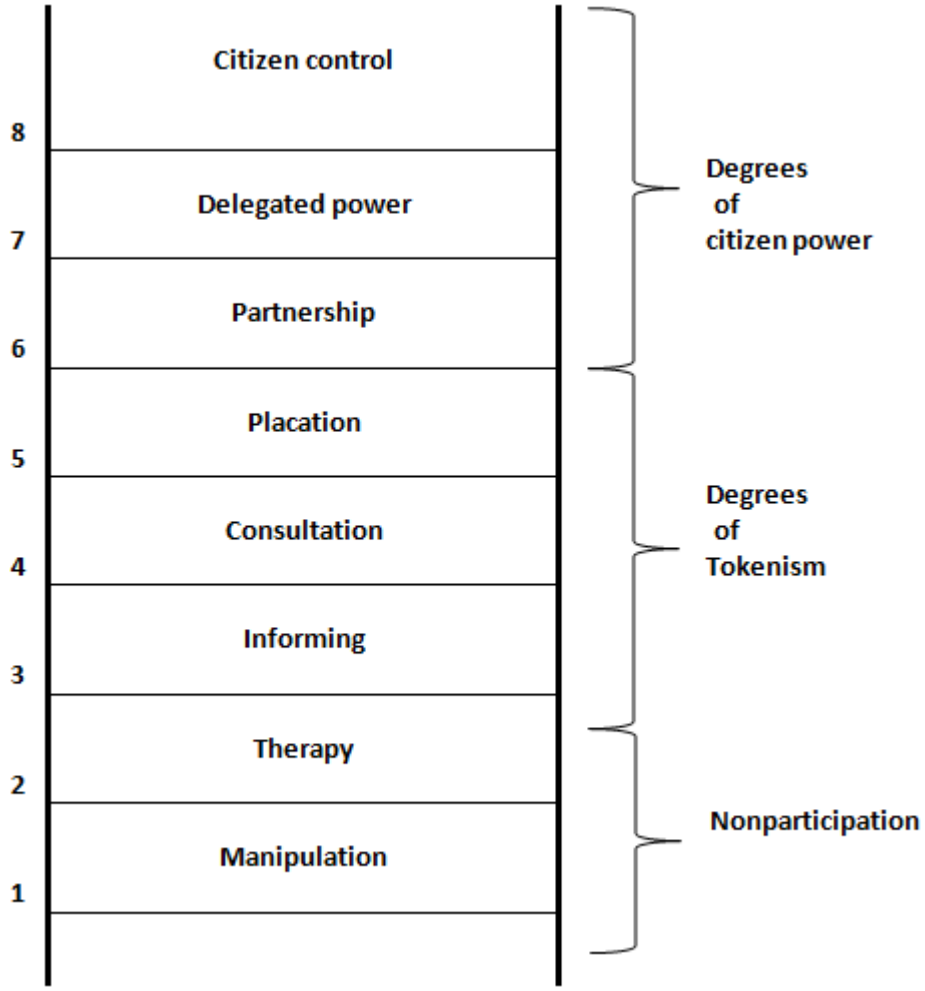


Figure 2.2: Eight rungs of citizen participation (Arnstein, 1969)

The results also indicate that some LAs have difficulty engaging the public by traditional means and only receive responses when draft plans are published. Public participation to be functioning effectively requires input from the public at the beginning of the process (Prendergast and Rybaczuk, 2005).

Traditional participatory methods can require a lot of the planners time. Planning departments are traditionally understaffed and considering the financial state of the LAs (Section 1.1.1) this is only going to get worse in the short term.

Principle 10 (United Nations declaration on Environment and Development) and Agenda 21 (United Nations action plan on sustainable development) to which Ireland is committed both call for increased public participation in environmental decision-making and led to the adoption in Europe of the Aarhus Convention. Agenda 21 also emphasises the role of geographic information in monitoring and analysing the state of the environment globally. PPGIS could be a solution to increase participation rates and aid monitoring and analysis (Hansen and Prosperi, 2005).

PPGIS in Ireland and beyond

In England the importance of community involvement in the planning process is shown by Kingston (2006). Six key principles are identified in the planning policy which includes using methods of involvement that are relevant to the communities and ensuring transparency and accessibility. Kingston underlines the importance of having a process to define and manage the community engagement which is referred to as a *"Statement of Community Involvement (SCI)" (Kingston, 2006, Pg 3))* .

In Ireland Kilkenny, Dún Laoghaire-Rathdown and Fingal County Councils have used technology to enhance public participation. Dún Laoghaire-Rathdown and Fingal County Councils both used digital maps during the consultation phase of the development of their LAPs. The ICT and Planning departments in Kilkenny created a wiki (Kilkenny Co.Co., 2014) to enable interested members of the public to participate online in a collaborative discussion around the development of future Local Area Plans (LAPs). The wiki is not GIS enabled but this could be the next development.

With these exceptions, the focus of current LA systems is on providing information, reporting problems or making enquiries and not about participation. PPGIS however is aimed at supporting and improving open and transparent dialogue which has a spatial dimension. Such systems allow citizens to discuss new proposals or identify issues relating to space and place within their community (Kingston et al., 2005). Cinderby et al. (2008) showed how in the case of air quality local knowledge of the issue was helpful in identifying where additional monitoring was required. LAs had been unaware of the issue.

Despite the wide use of GIS throughout Irish LAs, literature citing its use in public participation is limited. Two examples Haughey (2004) and Gonzalez et al. (2009) have been identified. Turner and Higgs (2003) identify the poor use of PPGIS in the UK and the lack of literature would suggest that things have not changed. Implementations in the UK include, the Slaithwaite planning for Real system (Kingston et al., 2005) which is referenced extensively in literature (See Simao et al. (2009), Kingston (2006), Green (2010), Chan (2007), Zhao and Coleman (2006), Tang and Waters (2005), McCall (2003), Hanzl (2007), Barton et al. (2005), Kingston et al. (2000), Wood (2005), Cinderby (2010)) and the Hackney regeneration project (Batty et al., 2003). In Ireland it would appear that the primary use of GIS for public participation has been to publish and disseminate development plans. In England they have gone a step further and have enabled on-line commenting in places however, both approaches fall short of deliberative participation.

Haughey (2004) examines the use of spatial information in a local community context. A PPGIS was designed and implemented in the Tallaght area of Dublin. The purpose of the study was to measure its effectiveness to disseminate and enable access to information. The system contained both expert and non-expert data. Expert data included aerial photographs, Ordinance Survey Ireland (OS*i*) digital maps, etc. and the non-expert data was obtained from the local community. It contained the publics' opinions and perceptions of housing, crime, pollution, recreational facilities and traffic issues and identified areas of local interest. They found that the participants were genuinely interested and excited by the potential of GIS, PPGIS and general ICT. Participants recognised the empowering nature of the technology and the networking capabilities. There was a suggestion that it could isolate some members of the community,

"Technology is a barrier… Community leaders of an older generation are not comfortable with technology." (Haughey, 2004, p14)

Challenges identified included the necessity to possess a computer to participate, computer skills and at its most basic level the ability to read. See section 2.3 for an extended list of PPGIS challenges. It is surmised that these comments may be the result of a lack of understanding of PPGIS or a fear of having to learn new skills. An interesting finding was that when the people began to analyse the LA data they found discrepancies which they were able to highlight. Vajjhala and Walker (2010) observed that eliciting local information could identify hidden vulnerabilities in planning processes.

Gonzalez et al. (2009) implemented a website to utilise public participation thus enabling the incorporation of spatially specific public perceptions into Strategic Environmental Assessments (SEAs). During the course of the study pilot tests involving a sample of 61 students who had a combination of no or basic GIS knowledge were carried out. They found that 75% of the students with GIS knowledge were able to complete all the steps they had to follow on the website compared to 39% of those with no GIS skills. The findings highlight the fact that any GIS interface needs to be carefully designed from the users perspective. In addition to the pilot tests two trials were carried out where by the website was deployed to two councils with limited success. While the provision of a web based participatory tool has the potential to stimulate public involvement and enhance transparency by making the information available to more people. Not unlike crowd sourcing, the trials exposed technical issues such as computer and GIS knowledge, institutional problems such as copyright and regulatory requirements that significantly influenced the use of PPGIS in this instance.

The Slaithwaite Planning For Real Initiative was developed to increase the level of public participation in various planning situations. An internet based GIS gave residents access to spatial data to pan, zoom and query. They also could comment on the spatial data. The response was very positive which lead to the conclusion that PPGIS is a method that can enhance public participation in the planning process.

The literature search identified many implementations of public participation through GIS worldwide, primarily in planning, e.g. land use, tourism, national parks, etc. but also in Health, Environmental, Ecological and Cultural. As Hanzl (2007) found the most cited examples were primarily experimental. Brown and Kyttä (2014) report, the number of studies wherein PPGIS data has been utilised to engage stakeholders in a process that provides for the review and refinement of the mapped results as part of a broader planning cycle is small. Finland is an innovator in its approach to "Open Government". In 2012, the Finnish government approved the use of "Open Ministry" a technology platform for citizens who want to get new laws voted on in the country's parliament (Meyer, 2012). The citizens' initiative means that a citizen can bring a new law to parliament if they can get 50,000 of their fellow citizens to back them up within six months. Open government and participation have a significant basis in their legislation (Finland, 2013). The example given by Brown and Kyttä (2014) is the case of the city of Vaasa, Finland. PPGIS data produced by residents were used for an architectural competition where the opinions of residents were included in the competition proposals.

The consensus is that Internet-based GIS while not without its challenges (discussed in section 2.3) is an effective participatory tool. However there is an opposing view, Green (2010) concludes that the participant is not currently able to fully engage in the planning decision-making process through the use of visualisation tools. Green believes that work remains to understand the role of PPGIS in public participation and to provide convincing evidence that PPGIS can lead to greater legitimacy in planning and decision making.

Impact of open GIS

One possible reason for the lack of examples of PPGIS in Irish local government is a concern that the public aren't capable of using GIS. Miller (2006) posits that Google has provided the platform to support grassroots activism and public participation. As McCall and Dunn (2012, Pg 89) puts it, Google Earth brings us closer to the *"democratic management of geo-information"*. Google Earth and Google Maps were released in 2005 and many implementations of PPGIS utilise the technology. See Lefer et al. (2008), Green (2010), Beyer et al. (2010), Zhong et al. (2008), Pocewicz et al. (2012), Brown (2012a), Brown et al. (2013), Brown and Weber (2013), Brown (2012b), Tsai et al. (2013), Fritz et

al. (2012), Bugs et al. (2010), Brown et al. (2014) for studies that implement Google mapping technology.

Since then many others have followed including Microsoft Virtual Earth, Bing Maps, Open Maps and a plethora of others. The GIS awareness issues experienced in Gonzalez et al. (2009) should be less apparent now as GIS has become ubiquitous thanks to Google Maps (Brown and Weber, 2011) and the growth in smart phones and tablets. The expense of GIS and the expertise required to engage with it is cited as a barrier to its use in public participation however, this tends to be in older research, e.g. Al-Kodmany (2000). A number of LAs including Kilkenny, Sligo, Tipperary, Waterford and Wexford County Councils, provide service information on Google Maps.

It is clear that the consensus is that the public are capable and willing to participate. PPGIS is being promoted by both open source and proprietary software providers. OpenStreetMap, Wikimapia and Hitchwiki are open collaborative initiatives while ESRI provides proprietary solutions.

OpenStreetMap is a free, editable map of the world. OpenStreetMap has over one million contributors. Users participate by editing the map. Once logged in, you can make improvements to the map that resolves issues or add data for everyone to see. Users have taken GPS units on walks, drives and cycling trips to record tracks and imported them to OpenStreetMap. Others have traced roads and features they find in satellite imagery into the map (OpenStreetMap, 2014).

Wikimapia is a multilingual collaborative map. Anyone can create place tags and share their knowledge. The aim of Wikimapia is to describe the whole world by accumulating as much valuable information about geographical objects as possible, organise it and make the data available free of charge to the public.

Wikimapia strives to make it as simple as possible for users to contribute so that prior experience with maps is not required. It is constantly changing in an effort to have up to date information (Wikimapia, 2014).

Hitchwiki is a collaborative website for gathering information about hitchhiking and other cheap means of transport. Users can mark locations on the map and write about their experience in the place (HITCHWIKI, 2014).

The Environmental Systems Research Institute (ESRI) provides a solution called “Story Maps”. A Story map is the combination of interactive web maps and personal data. According to ESRI the people who are creating story maps include GIS professionals,

planners, journalists, activists, web designers, bloggers, students, and amateur geographers (ESRI, 2014). A nice example of a story map is the “Current City of Windsor Construction Detours” (Windsor, 2014). This story map details all the road works in the city. It is not editable by the public however, it contains a lot of useful information.

2.2 Benefits of PPGIS

According to Zhao and Coleman (2006) PPGIS will help provide the infrastructure for more timely, direct and informed citizen engagement in land management policy, planning and decision-making. Carver comments that:

“GIS-based decision tools should provide the means by which stakeholders can explore a decision problem using existing information, experiment with possible solutions, view other people’s ideas, formulate their own views, and share these with the wider community.” (Carver, 2003, p64)

Brown and Weber (2013) argue that an Internet-based PPGIS method is economical, place-based and provides closer linkage with land use planning controls making it a valuable tool for tourism development planning and monitoring.

The tangible benefits of PPGIS include:

- The systems and services are accessible from any place, anytime, anywhere and theoretically for any period
- They are cost effective
- Opinions can be expressed freely and without fear
- Hierarchical information about the decision problem can be presented
- Complexity can be controlled depending on the citizens’ interest
- Information can be processed and responses provided with a quicker turn-around

The intention of public participation is to involve the general public in decisions about and the implications of social and economic change. In democratic societies participation for the majority of people is limited to choosing the government through the voting process and then lobbying them over issues of concern. As people have become more informed of issues through the media they are becoming more critical of the decisions that are being made on their behalf (Carver, 2003). PPGIS is a potential tool for people to air their concerns.

Finally, an important benefit of PPGIS is its potential to aid conflict resolution. Kingston (2006) states that the aim of PPGIS should be to reduce conflict in planning. As Kyem (2004) puts it, GIS is a planning tool with striking analytical capabilities and a great public

appeal that can be utilised for explicitly reasoned discussions to facilitate conflict resolution. It is undermined by the theory that human factors sustain conflicts. Kyem (2004) found that due to the nature of GIS its scope is limited to issues that include a spatial element. In addition, if the system is viewed with skepticism and distrust its capability to resolve conflicts is diminished. However, given the right set of circumstances such as, belief on both sides in the data and the evidence generated by the GIS, the technology could be a means for conflict resolution.

2.3 PPGIS Challenges

Challenges relating to PPGIS identified in the literature (Haughey, 2004, Barton et al., 2005, Anderson et al., 2009, Pocewicz et al., 2012, Gonzalez et al., 2009, Brown and Weber, 2013) include:

- Develop and retain public trust in the system
- The diversity of definitions and approaches to participatory mapping
- Relationships between participatory mapped attributes and physical places
- Spatial data layers that should be/not be included
- The integration of PPGIS data into planning decision support
- Moderation of the public input
- An evaluation system to provide questionnaires and interactive weighting and priority
- Gathering and review of participant feedback
- Security
- Privacy
- Complexity of data acquisition and sharing policies
- Challenges in initiating and sustaining meaningful engagement of stakeholders and participants
- Sampling to ensure an adequate baseline
- Longevity of resources and use of the decision-support tool at the community level
- Data quality – Non-experts entering data into the system
- Managing public expectations
- Focus on the technology rather than the outcome
- Marginalise or exclude elements of society

In the following subsections the most frequently referenced challenges from the literature are discussed.

Trust

Trust and confidence in the system are of primary concern to the public. The public's trust in the system is reflected in the response rate. Trust takes two forms, firstly that something will be done and secondly trust in the information given and the process. Loss of either of these key characteristics will damage the public perception of the process. Kingston (2007) states that regardless of the technology used or the user friendly design, if the comments and complaints submitted through the system are not quickly acted upon then the effort will have been in vain. Another challenge to overcome is the citizen's perception that nothing is likely to change because the same managers are making the decisions. All that has changed is the communication medium.

Managing Public Expectations

The public's expectations must be managed in any participatory process. Clarity must be offered from the offset that not all issues that arise during consultation can and will be acted upon. The LA should not be required to act on every opinion expressed. The LA should be allowed to balance the views of the public with the professional judgment of the LA planners. Ideally there will be compromise on both sides. Honesty is essential. LAs need to highlight these limitations at the start of any consultation. As happens when technology is implemented into a process there is a tendency to be distracted by the "Wow" factor however the outcome of the participation is what is critical (Kingston, 2006).

Lack of Public Interest

A primary argument for PPGIS is that it includes individuals and groups who would not otherwise participate in the participatory process. What if the public are not interested? Brown and Weber (2011), Brown (2012b) and Fritz et al. (2012) consider the situation where the public are not responding. Brown (2012b) and Pocewicz et al. (2012) state that Internet-based PPGIS participation rates have averaged 13 percent across five studies while paper-based PPGIS response rates have ranged from 15 percent to 47 percent, with an average of 30 percent across 11 surveys. Brown (2012b) and (Pocewicz et al., 2012) also state that survey data collection show declining response rates and Internet-based surveys show 11 percent lower response rates (on average) than other survey modes. Brown (2012b) found that using lotteries to increase participation had limited effect. It was also found that employing stakeholder groups did help to increase participation, but it did not increase the participation of the general public which is an important factor (Brown and Kyttä, 2014).

Data Quality

Concerns about the accuracy and validity of non-expert knowledge has been identified as a reason for the lack of movement in agencies in terms of PPGIS (Brown and Weber, 2011, Brown, 2012b, Fritz et al., 2012). Brown (2012b) and (Pocewicz et al., 2012) describe the situation where by a GIS implemented on Google Maps and Google Earth to is provided to the participants of a study. The system had very sophisticated zoom and the ability to switch between mapping modes with ease however, the majority of participants did not use these features. Participants used the default mapping level which had an insufficient resolution for marker placement. Observing this the default map scale was modified and it was found that fewer markers were placed. It is concluded that while technology has advanced, our understanding of "human factors" has not kept up. There is hope however, as Brown (2012a) describes how New Zealand residents were able to accurately map the location of native vegetation.

Evaluating PPGIS

In terms of public participation without a GIS element, Brown and Kyttä (2014) conclude that the scarcity of research is down to the fact that governments are reluctant to spend money on evaluation. Where evaluation has taken place it tends to be subjective rather than a structured evaluation. There is a lack of a universal format to evaluate public participation and academics are more focused on spatial data collection and analysis because these studies are more likely to be published. Where evaluation studies have been completed the focus is on the technology rather than the public participation.

If the recognised benefits of PPGIS are to be realised, real success stories based on experimental data that show its effect from the beginning to when a decision is made are essential. Brown and Kyttä (2014) identify thorough evaluation of PPGIS results as one of the most significant PPGIS research requirements.

Moderation

Goodchild and Li (2012) propose the use of group error validation and correction utilised successfully in crowd sourcing efforts such as Wikipedia, to address the issue of data quality inherent in Volunteered Geographic Information (VGI).

Marginalisation

Kingston (2006) highlights the potential to marginalise sectors of society due to the *"digital divide"*. The figures in Section 1.1.2 suggest that there is still a substantial proportion of Irish society vulnerable in this area. Institutions such as universities and LAs through libraries have an obligation to provide access to the Internet for members of the public

who cannot afford access at home (Al-Kodmany, 2000). AmericaSpeaks is an example from the U.S. whereby technology is utilised to extend the boundaries of town hall meetings. 4,300 participants were involved in the redevelopment of the World Trade Centre Site in New York.

2.4 Organisational Barriers to PPGIS

While the challenges related to PPGIS described above may be enough to explain the inertia in the public sector, other organisational barriers exist. Brown and Kyttä (2014) highlight the naivety of early proponents of PPGIS who believed that public sector planning and decision making could be democratised by allowing increased public access to spatial data and processes. The factors that constrain innovation in the public sector were not considered.

Brown (2012b) and Mulgan and Albury (2003) provide a comprehensive list of barriers to innovation and thus PPGIS, in the public sector. These include delivery pressures and burdens, a culture of risk aversion, lack of incentives or rewards to adopt innovation, short term budgets and planning horizons, poor skills in active risk management, over-reliance on high performers as sources of innovation and constraining cultural or organisational arrangements.

Gocmen and Ventura (2010) add training/understanding of technology, support for GIS, and staff availability to this list.

Beaumont et al. (2005) suggest greater ease of making service requests is likely to lead to greater demands for them which could be off putting for under resourced LAs. However, they must bear in mind that greater effectiveness of public service delivery is likely to be the outcome.

Brown and Weber (2013) suggest that governments and LAs are slow to implement PPGIS into planning processes because there is a fear that it will result in geographic discounting, however Brown and Weber have found that this fear is unnecessary.

2.5 Research priorities for PPGIS

Due to the fact that there is a dearth of research describing real world examples of PPGIS it is important to consider the PPGIS research priorities. Brown and Kyttä (2014) identify the most significant research items as:

- Understanding and increasing participation rates
- Identifying and controlling threats to spatial data quality
- Improving the public participation in PPGIS

- Evaluating the effectiveness of PPGIS

2.6 Summary

The theories and literature presented here impacted on the development and investigation of the research questions. The implementations of public participation through GIS identified were mainly experimental and primarily in planning, e.g. land use, tourism, national parks, etc. Other Health, Environmental, Ecological and Cultural implementations were also identified. In the case of planning there is little evidence that PPGIS has influenced specific land use decisions (Brown and Kyttä, 2014).

The Irish government and LAs are committed through various directives, European and otherwise, programmes and plans to increase the level of public participation in decision making. Due to the financial situation in LAs, public participation needs to be achieved as economically as possible.

The literature has revealed that in Ireland, LA perspectives, processes and attitudes need to be changed to motivate and encourage participation. In legislation there is no reference to “public participation” but the term “public consultation” is used. The use of the word “consultation” suggests that those in charge, can implement consultation processes to satisfy legal requirements rather than fostering any real partnership. The reason for this is not necessarily that public participation is not desirable but rather the amount of work involved. The process of organising, gathering and analysing the public input is just too much for the assigned resources. Considering the financial situation in LAs staff numbers are only going to reduce in the short term meaning that no meaningful participation can be achieved without a cost effective solution.

Internet based public participation via GIS is potentially a solution to address these issues. As it is a technological solution, the process can avail of increased automation reducing the number of staff to administer the process. If it is shared amongst all the LAs economies of scale could be achieved. Possibly a step too far that might encounter political objections,, would be to share the administration staff amongst the local authority sector.

Research has shown that the majority of citizens have access to the Internet, have the requisite computer skills and are willing to use e-Government services. Authorities need to publicise the services they provide and ensure that they are easy to find from their websites. PPGIS will not completely replace traditional methods of public participation such as town hall meetings, surveys and workshops as these methods will still be required to reach those that cannot participate online (Cinderby, 2010).

The methods used during this research will be outlined in Chapter 3. GIS in the context of public participation is the central theme for which both quantitative and qualitative data are collected.

3 Methodology and Fieldwork

3.1 Introduction

This chapter details the methodological approach that was taken. The study consisted of a review of LA websites, a survey, semi-structured interviews and an analysis of secondary data.

The first stage of the study consisted of a review of LA websites and an anonymous, self-administered online survey of the GIS Officers and staff in the 31 county and city councils around Ireland.

As part of the survey the participants were requested to opt-in for a follow up interview which became stage 2 of the study.

Finally stage 3, in addition to the data collected during stages one and two, secondary data collected from "fixyourstreets.ie" for the period 2nd of August 2011 to the 9th July 2014 were analysed.

3.2 Research Approaches

Research is classified based on the intended purpose and can be exploratory, descriptive, analytical/explanatory or predictive. Research can have many purposes or a combination of purposes for example, to explain a new phenomenon, generate new knowledge or investigate a situation.

The research undertaken in this study attempted to investigate the situation of PPGIS in Irish local government and had three primary objectives:

1. To establish the extent of the use of PPGIS in Irish local government to date
2. To establish if there is a demand within Irish local government to extend the role of PPGIS
3. To identify the existing barriers to the utilisation of PPGIS in Irish local government

The study is predominantly descriptive due to the fact that the aims are to identify and obtain information however, there is an analytical or explanatory dimension to the study in the third objective which is to identify the barriers and attempt to understand why? There are a number of aspects that make up a research approach. Saunders et al. (2011) describe research as an "onion" due to the many layers involved (Figure 3.1).

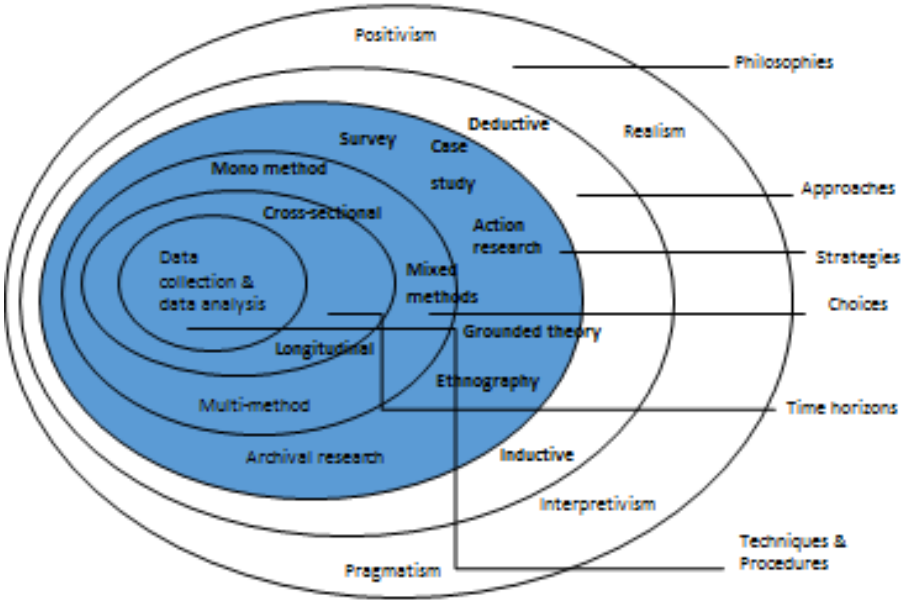


Figure 3.1: The research “onion” (Saunders et al., 2011)

3.2.1 Philosophy

The outer layer of the “onion” is the research philosophy. Research philosophy relates to the development of knowledge and the nature of that knowledge. Research philosophy has three main divisions; Epistemology, Ontology and Axiology. Epistemology is the study of knowledge, e.g. what is knowledge? or what are the sources?, Ontology is the study of "reality" or “being” and finally, Axiology is the study of values, e.g. aesthetics and Ethics.

It is an important consideration because it forms the basis of the research strategy and the methods selected as part of that strategy. Saunders et al identify four research philosophies: Positivism, Realism, Interpretivism and Pragmatism. These will be briefly discussed.

Positivism is based on the belief that there is a real world out there independent of us, but that we can learn about it from observation. Data is generally but not exclusively quantitative and is gathered through experiments and random sampling.

Interpretivism is based on the belief that knowledge is socially constructed. Data is generally but not exclusively qualitative. An interpretivist should attempt to understand subjective reality to understand motives, actions and intentions.

Realism is based on the belief that reality exists that is independent of human beliefs. It assumes that social forces and processes affect people. The approach taken is that of positivism. It recognises that people are not objects hence cannot be studied as in natural sciences. People’s social constructed environment must be understood.

Pragmatism is an acknowledgement that choosing either positivism or interpretivism is not always possible. Pragmatism is guided by “whatever works” or in Feyerabend’s words, anything goes.

It is said that there is no best philosophy. It is a matter of selecting the “better” philosophy based on the research question, following it and being able to defend the decision. This is a pragmatic approach. In this study the approach is pragmatic and uses a mix of methodological approaches. The responses to the survey and the interviews are a combination of objective and subjective data and the analysis in turn will be objective with a degree of subjectivity. For this reason the philosophy that best suited the research objectives was a combination of positivist and interpretivist which compliments Information System (IS) research.

3.2.3 Mixed Method

Three primary methods of data gathering were used. A review of LA websites and an online survey backed up by interviews. Secondary data from the “fixyourstreets.ie” database was also analysed. This provides a degree of triangulation as greater than two data sources are used to corroborate the research findings. The data collected includes both quantitative and qualitative data. Quantitative data is information that can be measured and expressed in numbers. Qualitative data is information about qualities that can’t be measured.

3.3 Research Strategies Considered

Before settling on the strategy that was followed in this research two other strategies were considered. The first strategy was to base the research solely on secondary data by undertaking a systematic literature review (meta research) to answer the question: “what are the benefits of PPGIS for Irish Local Authorities?”. The objectives of the systematic review would have been to:

- Examine the empirical evidence to identify determinants of PPGIS
- Analyse empirical evidence of the benefits and challenges of PPGIS determined in primary studies
- Determine the value of PPGIS and its impact on decision making
- Based on the empirical evidence from the primary studies, propose a model for PPGIS
- Provide guidelines for the use of PPGIS

Following discussion with the research supervisor it was decided that more value would be attained by gathering primary data from the LAs. With this data it would be possible to

establish the current use and views of PPGIS in the LAs which had not been investigated prior to this study.

The second strategy considered was an action research study. The literature would be reviewed to identify the primary uses of PPGIS in public and private organisations and the most popular technologies utilised. While this might be an interesting approach for a more protracted study, the time available made this impractical in this instance.

3.4 Research Strategy

The research strategy adopted was influenced by three factors. Firstly the objectives of the study, secondly the research philosophy and thirdly the data and resources that were available.

3.4.1 Online Survey

Stage one of the research was a survey to gather data regarding the use, views of PPGIS and motives, in LAs. The survey was designed following an extensive review of the literature and a review of the websites of all 31 city and county councils. The intention of the review of the LA websites was to access the websites like a member of the public and try and find public GIS interfaces (See Appendix 2). The survey recipients had to read and agree to the survey terms and conditions, prior to completing the survey. As all councils were included in the survey, there was no sampling involved.

The survey design was influenced by other surveys that were carried out with similar objectives on differing subject matters and were successful. A data requirements table which detailed the questions, their variables and the data to be gathered was used. This was useful to detail each question, of which there were initially 40 and reduce them to the 31 for the initial pilot survey. The survey was carried out online via Survey Monkey.

The survey pilot groups comprised participants with and without GIS knowledge. This approach was taken to ensure that the questions were generally understood. There was an initial pilot of the survey. The pilot findings and feedback were incorporated and it was submitted for expert review. The survey was then piloted for a second time. The use of the data requirements table and the pilots helped to ensure the questions posed could answer the research questions, i.e. the internal validity and that the same type of information is elicited each time they are used under the same circumstances, i.e. the reliability.

Following the pilots and review of the feedback received, 26 questions were used. An open question was included at the end of the survey where respondents could comment or add anything that was not specifically asked for in the preceding questions. In some

instances not all respondents answered the question. In no instance was it more than two respondents. The analysis is detailed in Chapter 4. The first question contained all the important information relating to the study including a definition of PPGIS. This definition was included to ensure that the participants had a common understanding of the subject matter. The remaining questions consisted of a combination of open and closed (Likert-type scale, ranking and opinion Yes/No type) and were split into four divisions:

- General GIS – The purpose of this section was to establish the GIS scene and included time in role, characteristics of current GIS etc.
- Demand for GIS – The purpose of this section was to gauge the demand for GIS
- Leadership, Unity and Direction – The purpose of this section was to try and establish how to extend the use of PPGIS
- Barriers to PPGIS – The purpose of this section was to establish the barriers to the use of PPGIS in Irish local government

A four point Likert-type scale which is sometimes called a "forced choice" method since there is no "neutral" option available, was used. The respondents were given the option to "Strongly Disagree", "Disagree", "Agree" or "Strongly Agree" to each question of this type. The use of an odd or even number of response categories was considered. The primary benefit of an even scale is that there is no neutral option, which may result in respondents being more discriminating and more thoughtful in their responses. It also eliminates the possibility of misinterpreting the mid-point. Considering the nature of the survey and the intended respondents it was concluded that these benefits were worth the potential risk of frustrating respondents by not having a neutral option.

The goal of this survey was to communicate with the local GIS experts in each LA as they were deemed to be the ones best positioned to answer the research questions. In addition to this, a 2012 internal LA survey (Higgins, 2012), quoted one of the respondents as saying *"GIS Coordinators are not consulted at the initiation of projects, with regard to data entry, technology, standards, resources, and very often data is prepared in a rushed manner without any proper planning".* It appeared counterintuitive that the resident GIS experts were not consulted, thus this research would attempt to investigate PPGIS from their perspective. It was hoped that participants would be willing to contribute and that the opinions received would be new.

Higgins (2012) found that there were 68 people, primarily GIS Coordinators/Officers and GIS Technicians, working full or part time in GIS in LAs. The aim of the survey was to receive a single response from the GIS Officer/Coordinator in each LA, i.e. 31 responses.

This would not be easily achieved considering not all LAs had a GIS Officer at the time. By the 18th of June 2014, closing date for the survey, 35 responses had been received of which 16 were partially complete. Eight merely consented to participate and the other eight only completed the first page. As they did not answer question 29 in which they agree to submit their answers, the surveys had to be excluded under the terms of the ethics application. In addition to this, there is no indication that they considered the other questions on the survey because they never chose to flag the survey as complete. This means that 19 of the responses were analysed, an effective response rate of 61%.

In a bid to ensure the highest response rate, the GIS User Group facilitator in the Local Government Management Agency (LGMA) was asked to provide an introduction to the GIS User Group. They sent out an email with a link to the survey and the survey details on the 7th of May 2014. In parallel, a post was made on the GIS User Group discussion board with an invitation to complete the survey and the associated documentation attached. This approach was taken as it was considered that the members would be more likely to respond if they knew who it was coming from and it had the backing of the facilitator of the user group.

The response rate for the first week was low. An error had been made with the mailing list used and the majority of GIS Officers and staff had not received the invitation. A second email was sent. Following this email, the response rate began to grow. The survey remained open until the 18th of June 2014. During this time two reminders were sent via email and the GIS User Group discussion board, thanking those that had responded and asking those that had not, to participate. In addition to the emails I attended the GIS User Group meeting and introduced myself and the project.

The results of the survey analysis can be found in Chapter 4.

3.4.2 Interviews

Stage three of the research was the interviews. Six of those that responded to the survey volunteered for interview. Contact was made to schedule the interviews following the initial analysis of the survey data. Three of the six respondents were available for interview. The interviews were conducted over the telephone, notes were taken in addition to recording the interviews to ensure accurate analysis. The interviewees were sent the Interview Informed Consent and Interview Participant Information Sheet documents and asked to sign and return them.

The list of interview questions was compiled following an extensive review of the literature and the review of the LA websites. The aim of the interview questions was to delve deeper

into areas that were not possible to reach in the survey. A subset of twelve questions was taken and adapted for each interviewee. The interviews were not rigid and additional aspects were examined during the course of the conversation. At the beginning of each interview, five minutes was allowed to ensure the interviewee understood the purpose of the interview, could ask any questions and confirm that they were comfortable with the fact that the interview would be recorded. To start each participant was asked to describe their role in their LA. The interview that followed consisted of a combination of open, closed and probing questions. The average time for the interviews was 50 minutes and the analysis can be found in Chapter 4.

3.4.3 Secondary Data

Finally stage three of the research was an analysis of secondary data. The primary objective was to measure the success of an operational PPGIS within Irish local government. The "fixyourstreet.ie" data is publically available via an applications programming interface (API) on the internet. There is a second API that LAs use to retrieve their incidents, however access to this enhanced API could not be attained.

To obtain the data, a SQL Server database was created and an application was written in C# to query the API and save it to the local database. There was a limit of 500 incidents that could be returned in a single request so a mechanism was required to send multiple requests to the API. With the data saved locally, a mechanism to identify the LA associated with the incident was required.

Google provide an API which can identify the LA based on latitude and longitude coordinates (geocode). The accuracy of the Google API is a concern however, random sampling of the data suggested that the API is correct. The assumption is that the map location of the reported incident provided by the member of public is accurate. The Google API limited the number of matches that were allowed from a single machine per day so the process was carried out over a number of days.

The data from "fixyourstreet.ie" was analysed using Microsoft Excel 2013 Power Query. This is a new feature of Microsoft Excel which enabled sophisticated analysis with a steep learning curve.

The findings of the secondary data analysis can be found in Chapter 4.

3.5 Research Ethics

Trinity College Dublin takes research ethics seriously and has a strict procedure. Prior to commencing the data collection via the survey and interviews, an application for ethics

approval had to be completed. This application ensures that any potential ethical issues such as conflicts of interest are identified. It also ensures that surveys are designed that respect the participant's right to confidentiality and to withdraw from the study at any time.

The application consisted of a number of documents. A project proposal which contained the title of the study, the purpose, the methods used, the participants, i.e. how they were selected?, any ethical considerations and a link to the online survey. A survey and interviews were identified for data gathering and thus required an Informed Consent Form and Participant Information Sheet for each method.

Once all this information was compiled it was submitted to the research supervisor along with the application form for their review. Following their approval the application was submitted via email on the 4th of April 2014. A response was received on the 10th of April requesting some corrections and an additional Board of Management Consent Form and Information Sheet. The application was resubmitted including the corrections on the 11th of April and approval received later that day. Approval to complete the research was attained from an assistant CEO of the LGMA.

3.6 Lessons Learned

3.6.1 Research Topic

Arguably the most difficult part of the entire process was the selection of the research topic. Extensive reading and deliberation was carried out on a number of topics. Originally it was intended to focus on information security and data breaches. It is an interesting and important aspect of IS. A data source of data breaches in the U.S.A. was identified and similar was sought for Ireland. The intension was to categorise the data breaches by the root cause. The problem was the absence of root cause data in the public domain. The primary reason for this was determined to be the sensitivity of this information. Changing direction meant that a substantial amount of research was wasted however, this due diligence prior to settling on a topic ensured that an achievable project was undertaken.

3.6.2 Online Survey

The use of the data requirements table to design the survey and the numerous pilots were crucial for choosing the right questions and ensuring they were understandable. When sending the initial email to the participants the wrong distribution group was used. This was an understandable error, however had it not been noticed it could have resulted in the failure of the survey. As the email was sent by a third party a check would be included in future to prevent it happening. The task of getting people to participate in the survey is a difficult one. Due to the fact that the survey was anonymous and thus it was not possible

to filter the distribution list, it was a concern when sending reminders that they could be seen as an annoyance. In spite of the fact that the project was introduced by member of the GIS User Group and presented to the group, the response rate could have been higher. Next time an incentive, such as a prize, could be used to increase the response rate.

3.6.3 Interviews

The approach taken to find participants for interview was to place an option on the survey that asked the respondent to opt-in for a follow-up interview. The theory was that those most interested in GIS and the concept of PPGIS would opt-in. Six of those that responded to the survey opted-in for a follow up interview which was a reasonably good response. Again, the use of an incentive might have led to an increased uptake.

Once the survey was closed and initial analysis was completed, those that opted-in for interview were contacted to schedule the interview. At this point it was the end of June and a number of the interviewees were out of office on leave which delayed the data gathering process slightly. In the end due to annual leave or other issues three respondents were interviewed. In this instance it could not be avoided as the extra time allowed to gather survey responses was essential, however this would be taken into account in future.

4 Findings and Analysis

4.1 Introduction

This chapter details how the quantitative and qualitative data collected in the survey, interviews and from “fixyourstreets.ie” were analysed and communicates the findings. A review of all the LA websites was carried out prior to the survey to quantify the extent of use of PPGIS against which the survey responses could be compared. It was found that all LAs bar one had a GIS with a mapping feature of some description for displaying planning applications. The systems were informational with no means to accept communication from the public. Planning was the primary service area for which all LAs had a public GIS. A number of LAs use GIS to map other LA services such as play grounds, parks, libraries, tourist attractions etc.. Some LAs provided GIS enabled issue reporting systems (See Appendix 2). This exercise highlighted the differing standards of GIS that are available to the public. Standards range from the sophisticated to the very basic.

4.2 Survey Analysis

The survey was structured into four divisions and the findings of the individual analysis and cross tabulation are detailed in the subsequent sections.

4.2.1 Respondent Information

The survey was anonymous, however two aspects of respondent information were obtained: the length of time that the respondents are in their current role and the general nature of the work that they do. It was found that 89% of respondents are in their role greater than 5 years (figure 4.1). In terms of their role (figure 4.2), the majority of respondents (69%) described their role as technical.

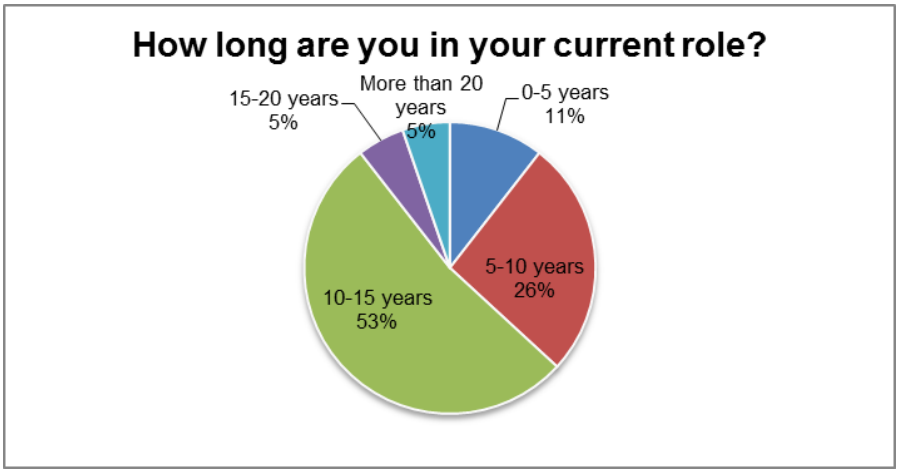


Figure 4.1: Classification of respondents by time in current role

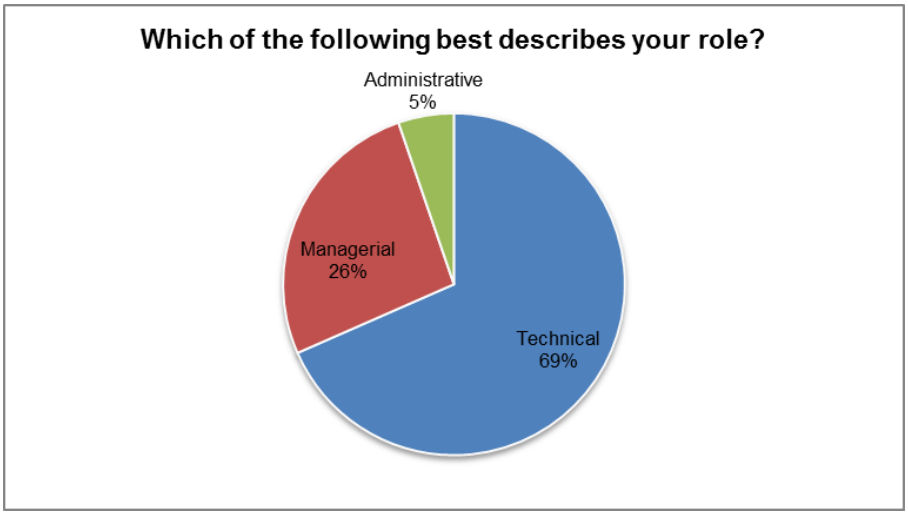


Figure 4.2: Classification of respondents by of role

4.2.2 General GIS

The purpose of this section of the survey (question 2 to 7) was to establish the extent to which PPGIS is currently used in Irish local government. One of the questions was Likert-type scale, for which the respondents were requested to indicate if they "Strongly Disagree", "Disagree", "Agree" or "Strongly Agree" with each statement. A 4 point scale was utilised, therefore a score of 4 indicated that the respondent strongly agreed with the statement while a score of 1 indicated that the respondent strongly disagreed. There were also three "Tick all that apply".

If a web based PPGIS is going to be a success, it is essential that the public is able to use it. In recent years Google and Bing, amongst others have provided public GIS offerings gratis, giving the public the opportunity to use them and familiarise themselves with the features and terminology. The respondents were asked if they thought that the general public were now capable of using PPGIS. The respondents agreed that the general public is now capable of using PPGIS (Table 4.1).

Table 4.1: "General GIS" Likert-type scale question mean result

Question	Statement	Mean
4.	GOOGLE and Bing maps have raised GIS awareness and expertise amongst the general public to a level that they are now capable of using PPGIS.	3.3

Figure 4.3 displays the survey response to identify LA service areas that provide a GIS interface to the public. All respondents identified a public planning GIS, with roads and transport coming in second at 67% and recreation and amenity third at 56%. One respondent identified *"heritage and tourism"* as an "Other".

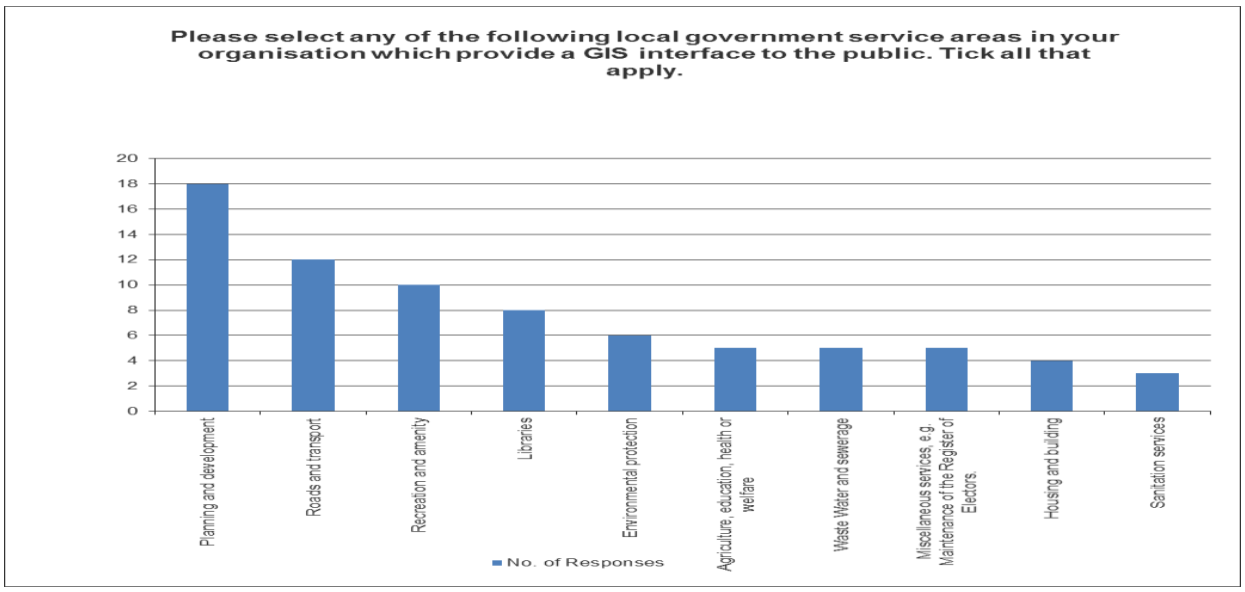


Figure 4.3: Public GIS interface by service area

It was concluded following the review of LA websites that the use of PPGIS is minimal being limited to "fixyourstreets.ie" and a couple of similar applications that individual authorities had implemented for reporting issues. The approach taken to test this conclusion and establish the extent of the current use of PPGIS in Irish local government was to firstly determine if the technology currently in use is capable of PPGIS and secondly establish the types of interaction with the public that are achieved through GIS.

In terms of the technology (figure 4.4), 95% said that their GIS is web-based and only 47% said it was capable of two-way communication. These features are a prerequisite for any PPGIS. In terms of ease of use which is also critical to PPGIS, 74% said their system had a user friendly design however, only 58% considered the system intuitive to use.

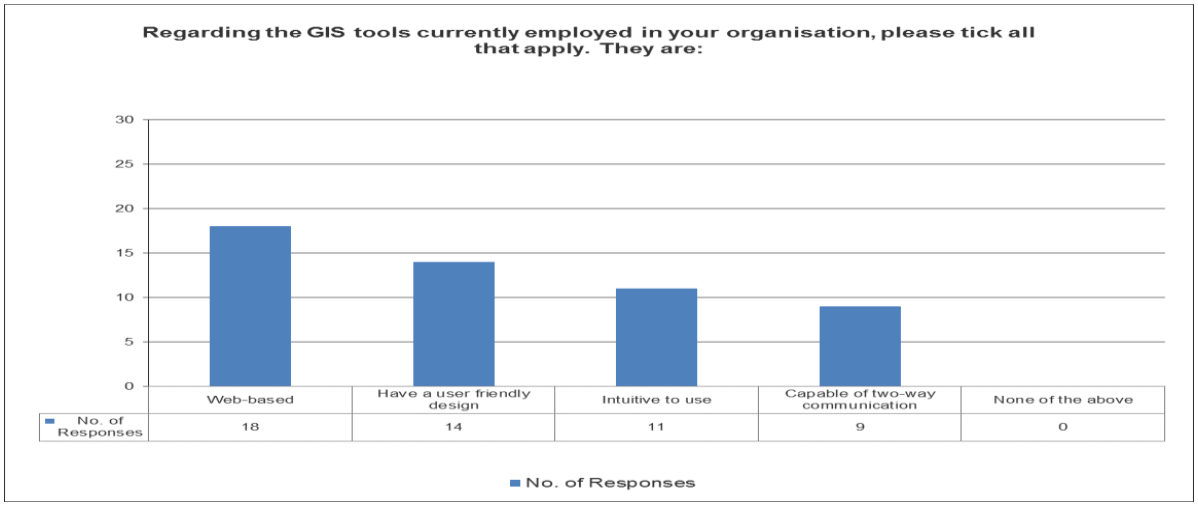


Figure 4.4: Characteristics of current GIS tools

All the respondents stated that information is provided to the citizens via GIS (see figure 4.5) however, only one respondent identified the use of GIS enabled blogs, wikis, surveys or free form questionnaires to engage the public. With regard to consultation and decision making powers only three respondents stated that GIS is used to consult with the public and two stated that they have an involvement in decision making. In terms of "Other", one respondent stated that a location based alert service called MapAlerter is used while another stated that, *"Citizens are involved in decision making through a submissions system where they can enter their comments and maps, but not through an interactive GIS interface."*.

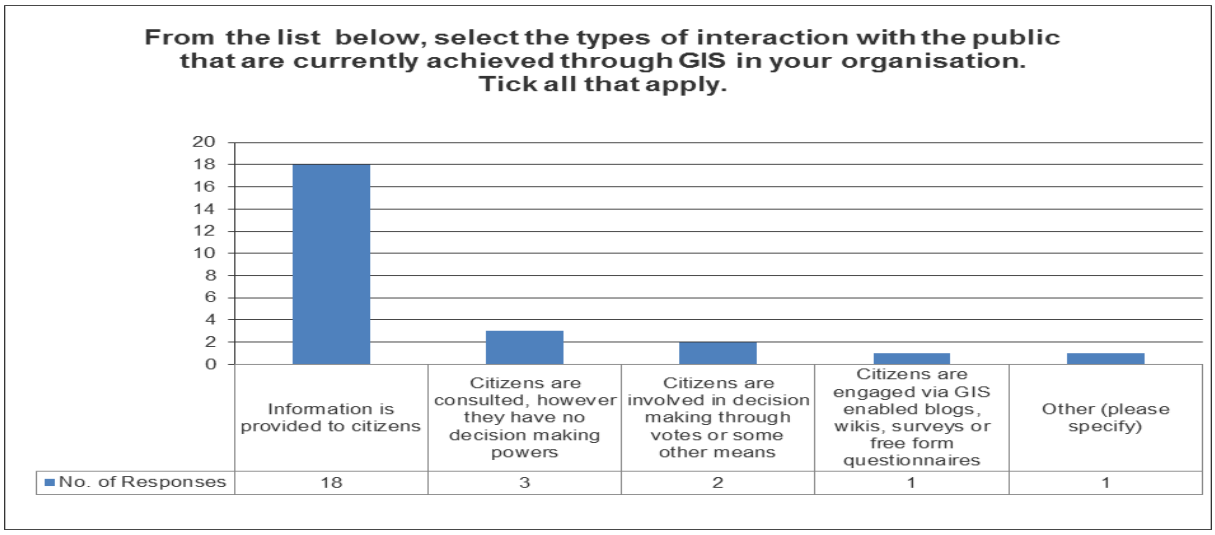


Figure 4.5: Types of public interaction achieved through GIS

The findings from the survey suggest that the initial observation that the use of PPGIS in Irish local government is minimal is valid.

4.2.3 Demand for PPGIS

The purpose of this section (question 8 to 19) of the survey was to establish if there is a demand or a need for PPGIS in Irish local government. Eight of the questions were Likert-type scale as described in section 4.2.2. There was a single opinion question for which the options were Yes, No and Don't know, one ranking and one tick all that apply. The literature review identified a number of advantages to the citizen and to government that can be obtained by incorporating PPGIS into the decision making process. The respondents were asked to rank the advantages to the citizen and to the government in order of importance. Figures 4.6 and 4.7 display the most highly ranked advantages to the citizen and government respectively. It is interesting to see that "achieve better policy or implementation decisions" ranked highly for both. The number one ranked advantage to the citizen is "influence the policy or implementation process".

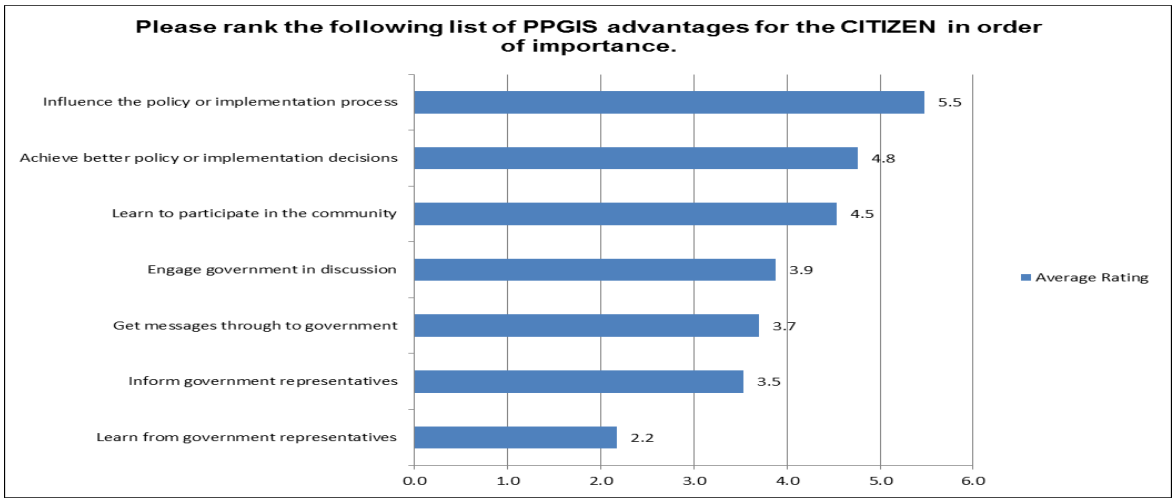


Figure 4.6: Advantages of PPGIS to the Citizen

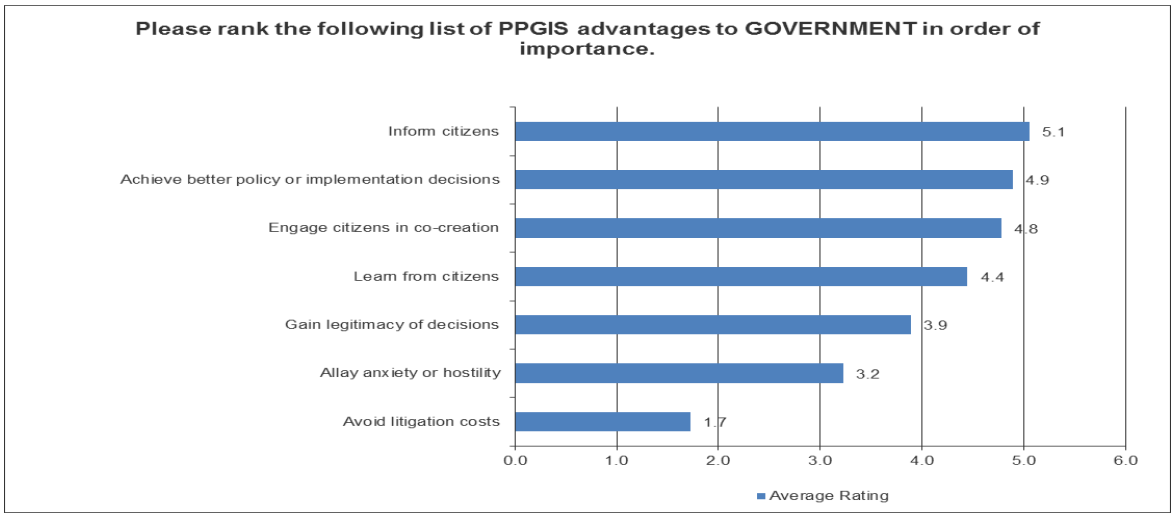


Figure 4.7: Advantages of PPGIS to Government

Table 4.2: "Demand for GIS" Likert-type scale questions mean results

Question	Statement	Mean
10.	Spatial visualisation and analysis capacities inherent in GIS empower citizens to:	
	share local knowledge	3.1
	prioritise issues	3
	consider things from a location perspective	3.4
	consider things from a population distribution perspective	3.1
11.	PPGIS can be used by planners to gather and analyse public opinions to identify potential conflicts.	3.2
12.	Involving citizens and stakeholders in the planning process from the earliest possible opportunity IS NOT an important part of a democratic planning process.	1.6
13.	GIS is a planning tool with analytical capabilities and a public appeal that can be utilised to facilitate conflict resolution.	3
15.	Increased public involvement in decision making is a key benefit of PPGIS.	3
16.	A GIS enabled discussion board or wiki would be useful to local authorities.	2.8
17.	In your organisation: GIS is seen as a strategic tool	2.8
	There is limited support for GIS as a decision support system	2.6
	There is an unwillingness to embrace the potential benefits of GIS	2.2
18.	Increased public use of GIS would alert management to its strategic potential.	3

The deductions that can be drawn from the mean scores displayed in table 4.2 are discussed below.

The action programme for effective local government aims to encourage participatory democracy. It states that it will explore ways to *"empower communities by facilitating direct, meaningful contact between councils and the communities they represent" (DECLG, 2012b, p159).* PPGIS is a medium through which this can be achieved. The respondents agreed that the spatial visualisation and analysis capacities inherent in GIS could empower citizens to share local knowledge, prioritise issues, consider things from a distribution perspective and that they could consider things from a location perspective.

In the literature, PPGIS is identified as a tool that could be used by planners to identify potential conflicts and as a means to facilitate conflict resolution. The respondents agree that PPGIS can be used to identify potential conflicts and that PPGIS can be used to facilitate conflict resolution.

The literature review highlighted involving citizens and stakeholders from the earliest possible opportunity as being an important part of a democratic planning process. Web-based PPGIS enables this so it was important to get the respondents opinion. The respondents significantly agreed with the literature. This question was deliberately designed to be negative to test the respondent's attention and ensure they were not just agreeing with every statement.

One of the primary objectives of eGovernment is to improve decision making and the current Irish government is actively pursuing a policy of eGovernment. One of the ways to improve decision making is to increase the public's involvement. The literature review identified increased public participation in decision making as a key benefit of PPGIS. The respondents' answers, with a mean score of 3, suggest respondents agree with this.

In the literature there are detailed descriptions of GIS enabled discussion boards and wikis. Collectively there is a slightly weak agreement from respondents (score of 2.8) however, in figure 4.8 it is clear to see that the majority think it is a good idea.

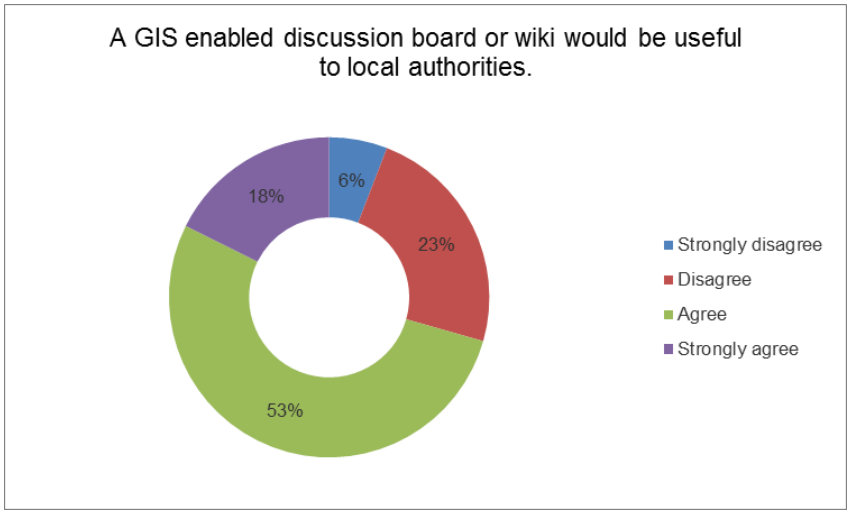
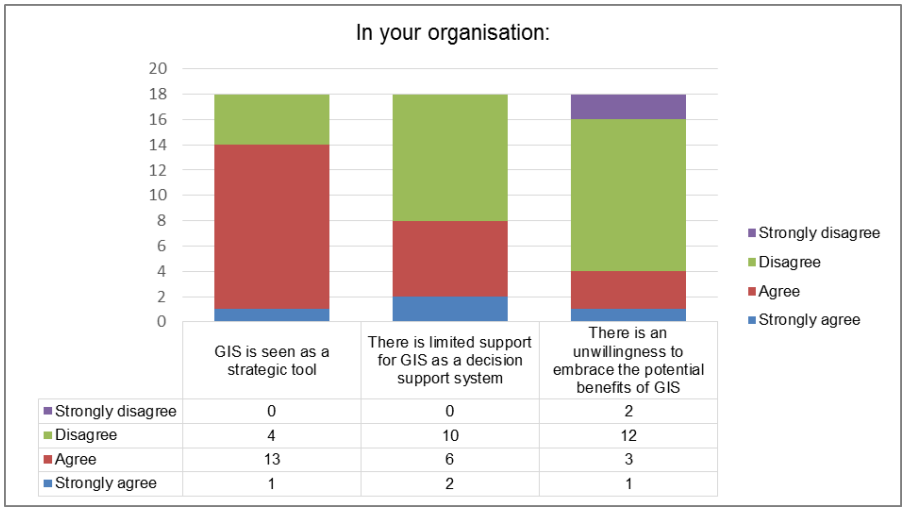


Figure 4.8: GIS enabled web tools

It has been suggested that GIS is not seen as a strategic tool in Irish LAs. The mean score of 2.8 suggests there is a weak agreement that GIS is seen as a strategic tool. Figure 4.9 gives a better indication of the strength of the agreement. Respondents are split about whether there is limited support for GIS as a decision support system and with a mean score of 2.2 the respondents' answers indicate that there is a willingness to embrace the benefits of GIS in the majority of Irish LAs. This suggests that there are significant differences in how GIS is perceived from LA to LA. The respondents support the theory (mean score of 3) that the increased public use of GIS will make management more aware of its strategic potential.



	GIS is seen as a strategic tool	There is limited support for GIS as a decision support system	There is an unwillingness to embrace the potential benefits of GIS
Strongly disagree	0	0	2
Disagree	4	10	12
Agree	13	6	3
Strongly agree	1	2	1

Figure 4.9: Perception of GIS in LAs

The respondents were asked to rank the primary service areas in terms of those that would most benefit from PPGIS. The respondents ranked planning & development, roads & transport and environmental protection as the top three. Figure 4.10 contains the complete ranking. This reflects the findings of the literature review.

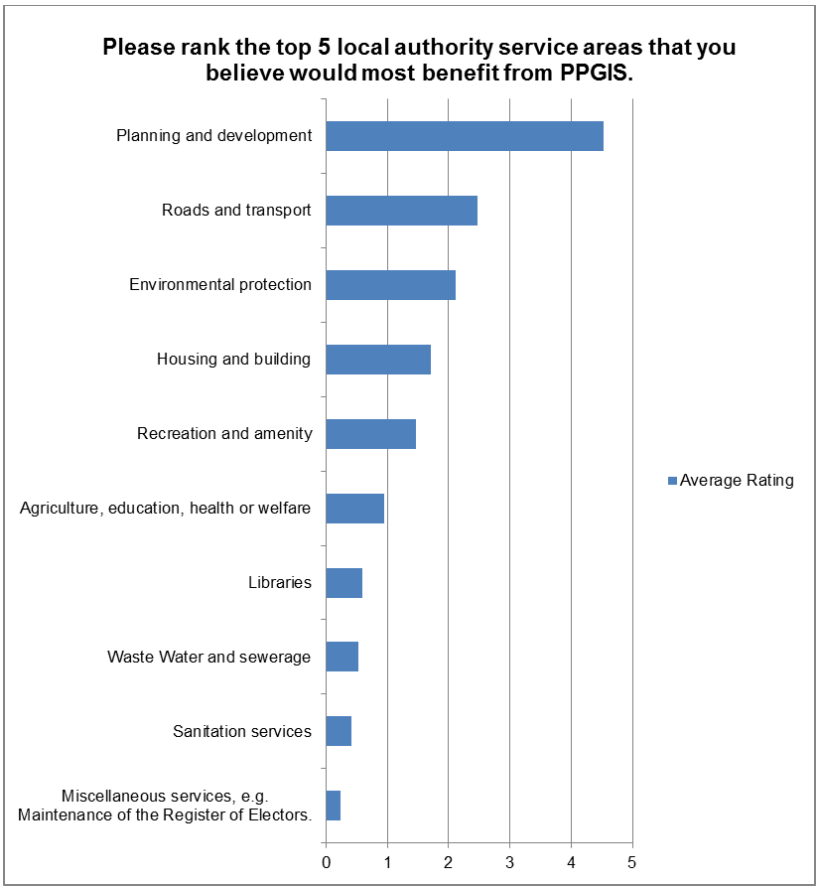


Figure 4.10: Service areas that would benefit most from PPGIS

The inclusion of PPGIS into the planning process is a big decision as “non-experts” will be partly responsible for the decision. The respondents’ opinion was sought on whether they believe Irish society is ready to allow this. With 63% responding “No” or “Don’t know” it is clear that if this opinion is representative of public opinion there could be resistance to an attempt to introduce PPGIS into the planning process (figure 4.11).

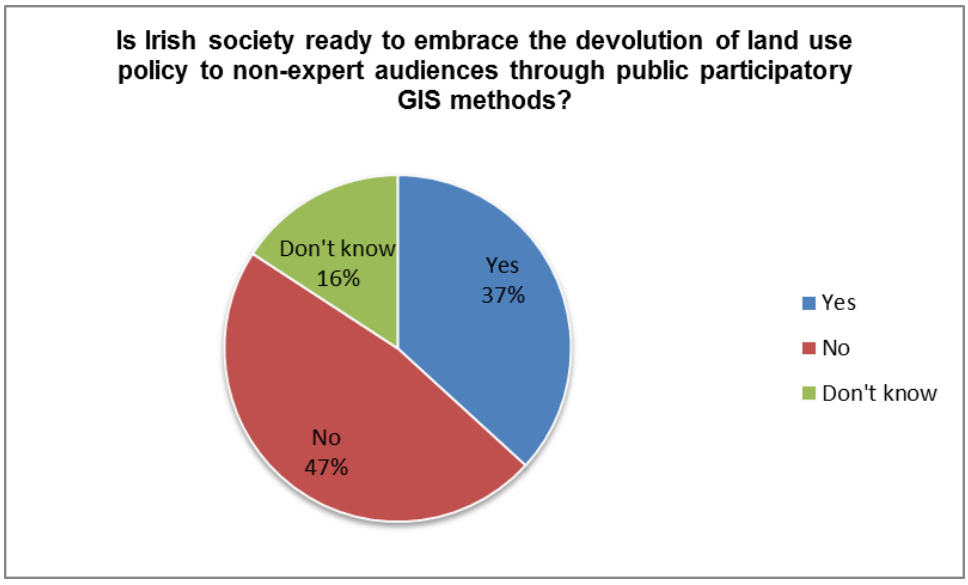


Figure 4.11: Is Irish society ready for PPGIS?

These findings suggest that there is support amongst GIS Officers for the use of PPGIS to facilitate communication between councils and the communities they represent.

4.2.4 Leadership, Unity and Direction

The purpose of this section of the survey (question 20 to 24) was to gather opinions regarding leadership, the willingness to work together and a potential direction for PPGIS. Three of the questions were Likert-type scale. Two of them were like those described in section 4.2.2. The exception is question 23, where a score of 4 indicated that the respondent believed the factor was essential and a score of one indicated that the respondent believed the factor was of no significance. There was a single opinion question for which the options were Yes, No and It would depend on circumstances and conditions.

Table 4.3: "Leadership, Unity, Direction" Likert-type scale questions mean results

Question	Statement	Mean
20.	GIS Officers/Staff in Irish Local Government consider a major barrier to inter local authority GIS integration to be:	
	the lack of data standards in the sector	2.9
	the lack of technology standards in the sector	2.4
21.	A single gateway to GIS data would provide a better service to the public.	2.7
23.	Rate the following factors in terms of their importance to the national adoption of PPGIS.	
	Public demand	3.0
	Funding	3.4
	Current GIS technology	3.1
	Local leadership and drive	3.6
	Central leadership and drive	3.4

The deductions that can be drawn from the mean scores displayed in table 4.3 are discussed below.

Since the economic collapse in September 2008, LA budgets have been significantly reduced. The focus is on doing more with less. To make the development of PPGIS cost effective, ensure the best service for the public and more appealing to management, a shared service is an option. Licensing, infrastructure, maintenance and support would be consolidated and the cost divided amongst the entire sector. A big part of such a shared enterprise would be the consolidation of the existing systems into a single architecture. It is often suggested that a major barrier to the integration of the individual LA GISs it the fact that there are numerous different technologies, storing the data in different formats. The respondents' answers suggest that the lack of technology standards is less of a barrier to integration than the lack of data standards. This is understandable considering the purpose of technology. It is a means to access, analyse and view the data. If the data format were standardised a single technology should be more easily applied.

Historically, Irish LAs have opposed the loss of control of ICT services therefore, the suggestion of a single GIS gateway for the entire country could be controversial. A score of 2.7 suggests that the respondents are not convinced that a single GIS gateway would provide a better service for the public, however figure 4.12 shows that the majority agree that it will.

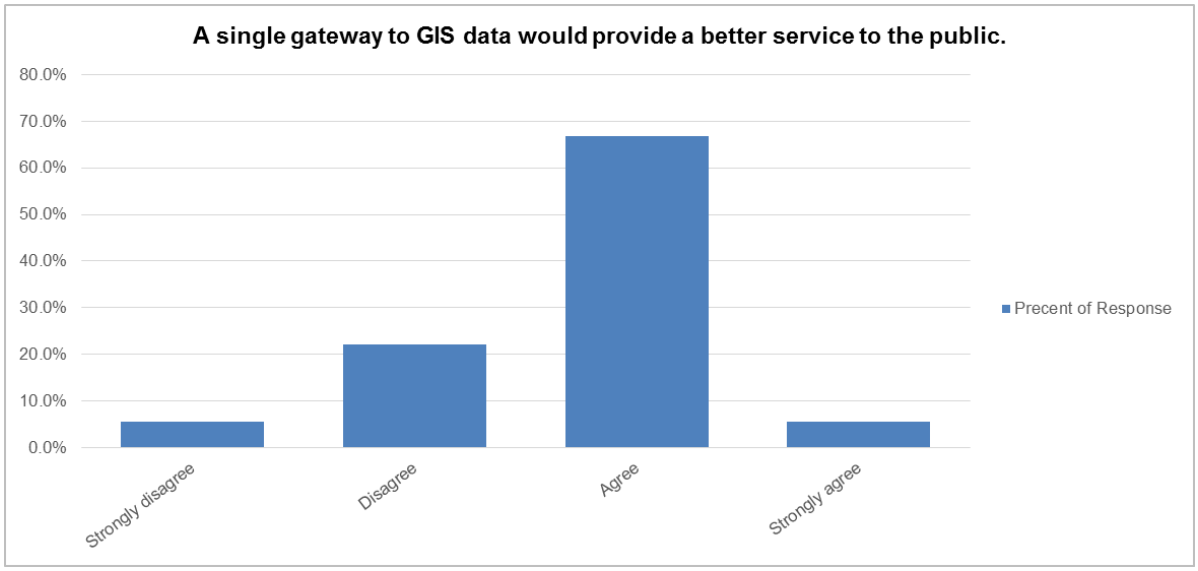


Figure 4.12: Single GIS gateway

Factors that generally influence the adoption of any process in Irish LAs include public demand, funding, local leadership & drive and central leadership & drive. In this instance the current GIS technology is a consideration as the entire process will succeed or fail based on the performance of the technology. The respondents' answers indicate that all five factors are important. It is interesting that "local leadership and drive" scored slightly lower than "central leadership and drive".

Respondents were asked if they would be willing to utilise a PPGIS that was hosted by another LA, i.e. share a service, as this is the current ICT policy. Figure 4.13 depicts that 5% responded with an outright "No". This means that the majority are willing to take a pragmatic approach and at least see the proposed solution before objecting. This shows the GIS Officers and staff are open minded which is an essential quality to avoid inertia.

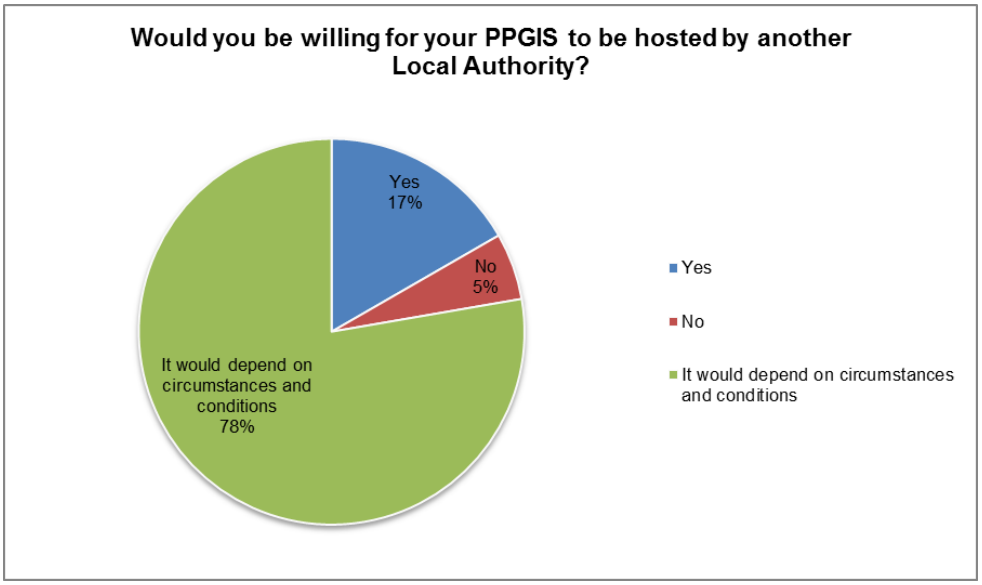


Figure 4.13: Utilise a shared PPGIS

The respondents identified leadership as the most important factor for the adoption of PPGIS and at this moment there is no GIS leader for the sector. It was important therefore to establish who the respondents believed should take the lead and promote GIS. The categorisation of responses can be found in figure 4.14.

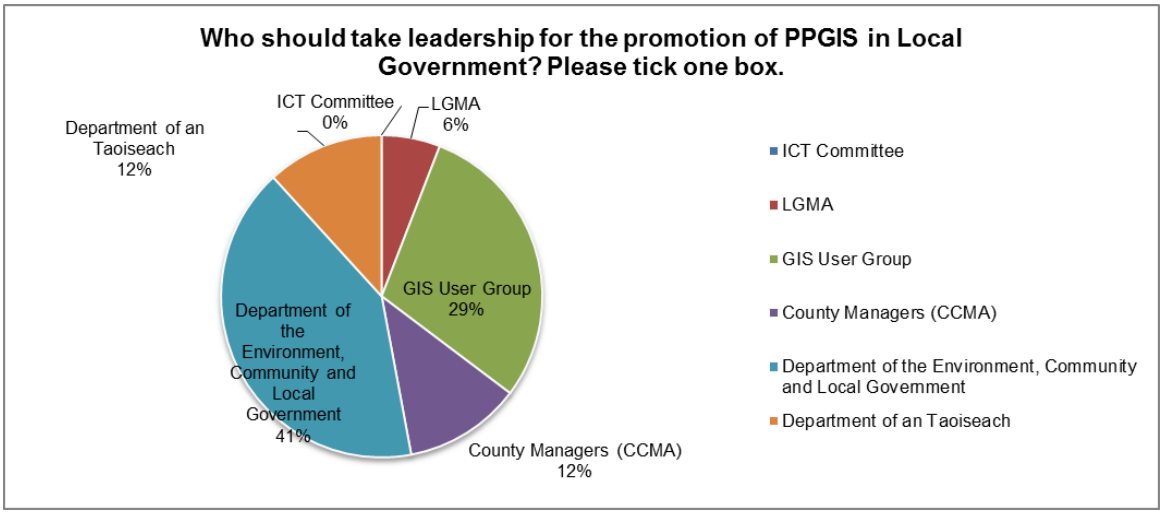


Figure 4.14: Leader to promote PPGIS

The GIS User Group and the DECLG get the largest number of votes however there is no outstanding winner. Each option with the exception of the ICT Committee received at least one vote. It is significant that no single organisation has shown itself to be a leader for such projects. The frustration is summed up in a comment left as "Other" which stated *"all of the above and none of the above"*.

4.2.5 Barriers to PPGIS

The purpose of this section (question 25 and 26) of the survey was to elicit opinions regarding the main barriers that exist to the adoption of PPGIS.

In the literature there are numerous barriers mentioned from standard ICT barriers such as lack of leadership to PPGIS specific barriers such as concerns about data quality, i.e. non-expert data entered by the public.

A list of barriers that inhibit standard ICT projects and PPGIS projects was generated. The respondents were asked to do two things:

1. Select the 5 main barriers to the adoption of PPGIS from the list
2. Rank the top 3 barriers

It was found (see figure 4.15) that the barriers to PPGIS in Irish local government most selected by respondents are “lack of leadership”, “culture change” and “concerns about data quality”. *“Lack of time”* and *“Public lack of confidence in the system”* were entered as “Other”. The respondents ranked “Lack of leadership” and “Concerns about data quality…” as number 1 and number 2 respectively.

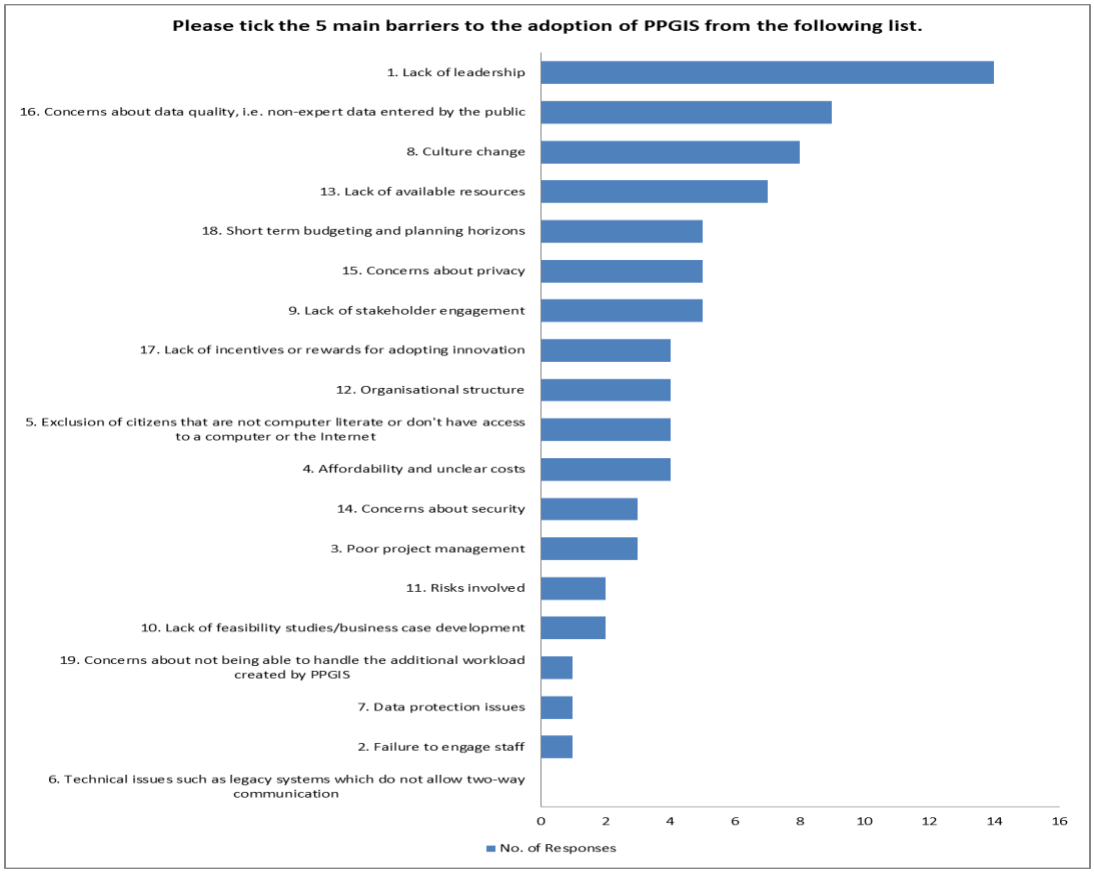


Figure 4.15: Main barriers to the adoption of PPGIS in Irish Local Government

Leadership was identified as an important factor for the adoption of PPGIS by the respondents. When this is combined with the fact that there was no consensus on who should promote PPGIS it shows that there is an obvious issue in the sector.

4.2.6 Comments or observations on PPGIS use

This final question on the survey was open and allowed the respondents the opportunity to offer up their comments and/or observations regarding the use of PPGIS. Seven respondents provided comments or observations on GIS/PPGIS use.

The responses regarding GIS and PPGIS were mainly positive with one respondent identifying transparent decision making as being what GIS should be all about.

It is pointed out that PPGIS is being used but it is its infancy. They believe that its use depends on a combination of factors; the technology in the LAs, the willingness of staff to interact with the public in this new way, the culture of innovation in the LA and the GIS officer's ability or skills.

Another respondent believed that it would be an excellent idea with particular relevance in the drafting of the County Development Plan. They identify its potential to streamline the current process, i.e. the public making submissions on the plan.

The barriers to its utilisation are highlighted with LA autonomy identified as a potential negative. There is a lack of a mandate to make changes at a national level. LAs have too much autonomy resulting in individual authorities taking the initiative and going it alone. This behavior gains media attention but does not necessarily ensure a properly implemented and thought out system. In addition to this, there are no agreed work priorities for GIS staff.

Technical issues can be overcome but leadership is essential. Change needs to come from the top to get traction and proper support. Senior management needs to be aware of what PPGIS can bring to a Council and its citizens in terms of decision making, citizen engagement and promotion of local democracy.

A big barrier to overcome is public apathy. It is believed that there is little interest in the public in additional consultative processes because they generally do not see any benefit or reward from the powers that be.

Finally it cannot be overlooked that not all citizens are computer literate with the older generation identified as being vulnerable to marginalisation in this respect.

4.2.7 Cross Tabulation

To test for a relationship between the role of the respondent and the responses, cross tabulation was used. It was found that respondents that described their role as "Managerial" and "Technical" differed in their response to question 17. Figure 4.16 depicts the difference.

Figure 4.16: Cross tabulation of question 17 responses with the respondents' role

It was also found that these respondents differed significantly in their response to question 21. Figure 4.17 shows that the technical respondents agree more with the use of a single GIS gateway than the managerial respondents.

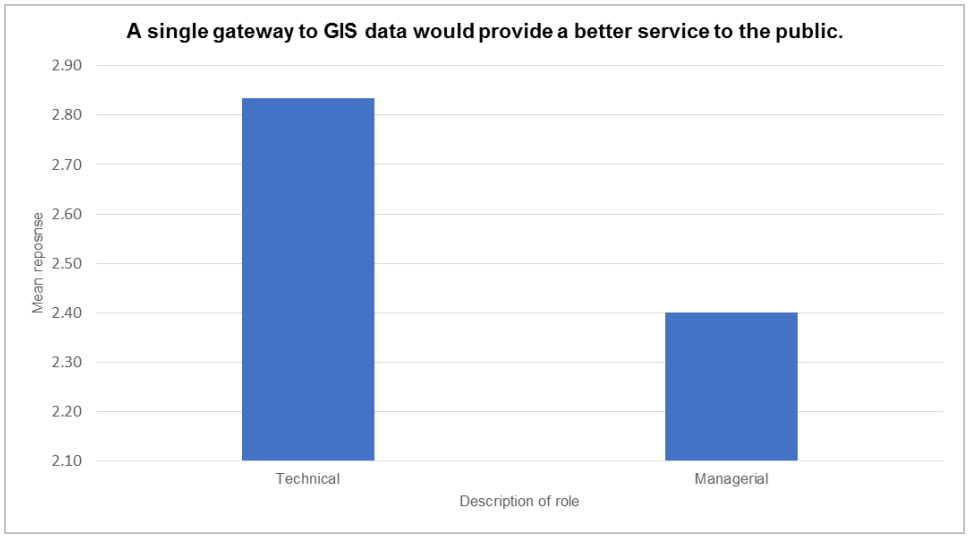


Figure 4.17: Cross tabulation of question 21 responses with the respondents' role

Question 17 relates to the perception of GIS within the LA and it is not uncommon for management and technical staff to differ in such circumstances. With regard to question 21 it is less understandable. Perhaps managerial staff are not concerned about the issue of cross LA boundary lookups.

4.3 Interviews

Three interviews were carried out with a member of the GIS staff from three separate LAs. To ensure the anonymity of the interviewees their LAs will not be disclosed. They represented a combination of city and county councils.

4.3.1 Role within local authority

All participants worked within a GIS functional area and the primary responsibility was to provide, promote and support the use GIS tools and services to the business areas within their LA. The development and implementation of a GIS strategy was also identified as a responsibility. It was noted that due to staff changes in some areas the GIS coordinator at times ends up doing the GIS work for some divisions, e.g. assistance for the development plan or project work such as analysing property charges. Time is also spent supporting the business areas in their use of the systems. All this operational activity has the effect of delaying the advancement new GIS features.

4.3.2 Capabilities of GIS

Interviewees were asked if they thought that decisions were made and then the maps were consulted to justify the decision.

Points made by the interviewees include:

- One of the interviewees suggested that this relates to the nature of the business area. They noticed that engineers tend to be more adept at reading maps and therefore incorporating them into decision making.
- Another interviewee identified that it is their responsibility to ensure this does not happen and that they help to integrate GIS into business processes. They would like to see senior management utilising GIS to greater degree.
- No longer is it the case that the development plan consultation is done without the GIS and the map simply used to present the final decision. The last development plan for this LA used the GIS to generate the zones etc. which were fed into the final report.
- Decisions are not completely transparent yet. Figures are derived from the GIS but full spatial analysis to decide the types of zoning is not carried out.
- The Irish planning system is unusual. It is possible to spend time doing the calculations and drawing up the zones taking all the variables into account and then the development plan goes out for consultation and people can lobby to have zonings changed.

- There is a need for a head planner that wants to be transparent, i.e. these are the data we have and this is why we made the decision. It is about proving what GIS can do for them before they are likely to commit.
- Resourcing is a big issue. Often the response from the planning department is *"we would love to do it but we just don't have the time"*.

All the interviewees agreed that GIS:

- is helping LAs make informed decisions about where services and resources should be located.
- that the visual mapping of LA services improves communication and provides a better understanding of the location of LA services and resources. One of the interviewees gave the example of how GIS was used to geocode refuse collection points which was then used to create new routes, schedule the collections and inform the households of the new schedule. When the business was sold this GIS data added value and resulted in a higher price of sale.
- that the visual mapping of services creates transparency of services and resources that would otherwise not have been seen, e.g. the public map portal offered by Roscommon County Council. An issue highlighted is that within a LA website only the services for that LA are mapped even though there could be a closer service in one of the neighbouring authorities. Sharing of this data is now possible and being actively pursued. In one of the LAs a project to establish a unified view of neighbouring LAs is currently on hold due to the project leader changing position.

Is the senior management team aware of these capabilities?

Generally it is accepted that awareness in management circles is growing. It was pointed out that there is a lack of awareness of the amount time and resources required to implement GIS solutions, e.g. gathering, cleansing and managing the data. It was also stated that GIS can sometimes be seen as an irritant that makes something that appears quite simple sound complicated. One way to improve awareness is to ensure that the next generation of senior management is comfortable with the technology and aware of its value.

4.3.3 Public GIS interfaces

In relation to public GIS interfaces two of the interviewees provide such services that incorporate maps. One believes that they are providing a good service with room for improvement and the other is currently working with a temporary solution. They are trying to balance the amount of data and complexity of the system taking into account the needs

of their users, primarily consultants and members of the public. The LA that currently does not have a mapping feature for their planning applications do have a search by address.

Would two-way communication add value?

Introduction of two–way communication would need to be done with a concrete objective in mind such as development plan submissions or planning application submissions. One of the LAs did use a GIS for the consultation process regarding their development plan and this process was referenced by one of the other interviewees as something they would like to implement. GIS is leading rather than the planning department so it would need their buy in and commitment of resources.

There is resistance in some sections to use GIS. Roads is highlighted however, the direction from the Department for Transport is that they have to use these tools.

4.3.4 What is your experience of PPGIS?

The majority of communications described were one way from the council to the public. “fixyourstreets.ie” and the use of digital mapping for development plan submissions in Fingal and Dún Laoghaire-Rathdown County Councils, were the main examples that the interviewees were aware of in Ireland. ARC GIS and ESRI Story maps were identified as having potential but the solution needs to be maintainable by the business owners. PPGIS was identified as having massive potential but with very little happening.

It was mentioned above that there was a missed opportunity when developing the Non-Principal Primary Residence (NPPR) website. It was proposed to integrate a map so people could identify their property but this was removed because it was deemed to be obstructing the payment process and LAs are still suffering from that decision as they cannot match payments to households. Work was carried out to geocode household charge data, but when this was transferred to the Revenue Commissioners they were not interested in the geo-data. Geo-data can be used to link data, e.g. household addresses thus increasing the efficiency of revenue collection and maximising the return.

PPGIS example: “fixyourstreets.ie”

All believed that the idea of “fixyourstreet.ie” is good.

Some of the issues identified include:

- Support in terms of the resources to act upon the incidents that are logged by the public has not been sufficient

- Map Genie would have been preferable to Google Maps as it would line up closer with the local maps
- If LAs could publish issues that they are aware of so incidents would not be logged twice

When it was highlighted that the number of incidents being logged in "fixyourstreet.ie" was consistent year on year suggesting that the public were supporting it, the counter argument was that the number should be significantly up year on year to show public trust. It was then highlighted that the service has not been publicised since its launch which was accepted as a possible reason for the small increases in usage.

Some LAs have not linked to "fixyourstreets.ie". Reasons offered up for this included:

- Lack of support from senior management
- The possibility that people will not be happy with the response timeline they are given which would be dictated by LA resources and budgets
- The possibility of being inundated with issues
- Accountability, e.g. a paper trail now exists for that pot hole
- The possibility of spurious reports due to the anonymity provided by the system

For PPGIS in general with planning taken as an example, apathy amongst the public is identified as an obstacle. What is the reward for the public for taking part?

Conflict resolution

In terms of conflict resolution none of the participants had observed its use in planning however, one of the interviewees described the situation that they were able to use data from the GIS to prove that the council was removing graffiti as requested. They also highlighted the potential to prevent conflict with the councillors because engineers when they meet with them are now logging the data directly into the system via mobile devices while in their presence so they know they can follow up on the progress the next time they meet.

4.3.5 Is there a demand for PPGIS?

One of the aims of the project was to establish if there is a demand for PPGIS amongst GIS Officers and Staff in Irish local government. It was pointed out that there is not a demand if you ask the managers as they currently stand. It has become clear from the interviews that there is a requirement rather than a demand for PPGIS or some other mechanism to increase involvement of citizens in decision making. The GIS staff

interviewed are all interested in implementing solutions if they can get the backing, time and resources.

One of the interviewees outlined exactly why PPGIS is required when they said that it is not easy to get LA services changed if you have a problem with them. They pointed out the hierarchy that exists from which a decision to implement change has to come and nowhere is the public consulted. They believe three things are needed to make this a success:

1. A process
2. Contributing citizens need to see that there input is important
3. Information needs to be fed to the decision makers

They believe that getting people involved before decisions are made is important to avoid situations where after a building is put in place people complain. It was identified that a councillor in one of the areas has included the facilitation of meaningful consultation with citizens on Council Plans as one of their areas of commitment.

4.3.6 Who should promote the use of PPGIS?

The question of how to promote PPGIS and expand its usage was put to the interviewees. All agreed that strong leadership and support are required. Communicating ideas upwards from the GIS User Group or an individual GIS Officer to the HIS Group to the CCMA is a challenge. If it comes from central government, e.g. the DECLG with “fixyourstreet.ie”, it is most likely to succeed.

The role of IT was highlighted as important to make the business areas aware of what is possible with PPGIS. This should lead to the business areas within LAs being the instigator and enlisting the GIS staff to solve their problems.

The creation of feasibility studies and business cases by the GIS User Group was suggested. These would then be presented at the various committees and forums with the hope of gaining backing from senior management.

DECLG has to get involved to resolve planning issues such as the over zoning of land, the power of councillors and the lobbying to change good decisions. If they say there should be more public consultation then it will happen.

What will make PPGIS a success?

The following are the key factors identified to make PPGIS a success:

- A central government initiative or a local maverick that believes it will be good for public relations
- Senior management need to back the initiative
- A sustained and wide scale marketing campaign is required to engage the public
- The public need to respond to these campaigns and participate
- Sufficient resources need to be assigned to analyse the data and act upon the public's input
- Resource numbers need to be maintained and not reassigned when the next priority project appears
- A means of data validation
- For the likes of development plans accurate data is essential

4.3.7 Disadvantages of PPGIS

In terms of the disadvantages of PPGIS, the main ones identified were the public visibility and potential extra workload. You have asked for input and there will be expectations that this input will be acted upon. This can cause extra work for under staffed sections which may only be making small changes which do not require a full consultation.

All agreed that PPGIS is not a replacement for traditional means of public consultation such as town hall meetings but rather a means to extend the boundaries of such meetings. It was suggested that regardless of the efficiencies that any system can introduce there will always be a requirement for a personal contact.

4.3.8 View on a National Spatial Data Infrastructure (NSDI)

All agreed that an NSDI would be a valuable resource however, collaboration from numerous government organisations is required. One interviewee suggested that GIS will continue to be used to solve problems but that its full potential will not be achieved until there is a national SDI. A good understanding exists about how a LA SDI could be brought about. Time, support and a small amount of funding are required to make it a reality. Accountability for the quality of the datasets was identified as a prerequisite for any SDI to be successful.

4.3.9 Barriers to PPGIS

The main barriers are gaining senior management support and resourcing. Also, the lack of project management is identified as an issue. Initiatives are passed down from central government without quantifying the work involved or taking into account the work that is ongoing in LAs.

4.3.10 General comments and observations

PPGIS has the ability to build effective business processes and could be used to manage complaints and develop LA customer relationships. This aspect of LA operations is identified as a weakness currently.

One participant commented that it was a good topic for a thesis and that they are very interested in the findings.

One of the participants asked the question, why shouldn't management teams be sitting around a meeting with maps showing information on where things are happening, e.g. incidents in "fixyourstreet.ie"?

In LAs sometimes there are numerous disparate systems all logging information in different formats and this all needs to be collated. The example of Irish Water is given whereby they are a green field site that operates a single system through which all data will be logged and staff are obliged to use it and trained sufficiently.

The difference in operations between one LA to another was highlighted regarding the development plans. One authority derived all its figures from the GIS while another did their calculations separately and the GIS was only used to produce the map.

4.4 "fixyourstreet.ie" Analysis

4.4.1 What is "fixyourstreet.ie"?

"fixyourstreet.ie" was launched on the 2nd of August 2011. According to fixyourstreet.ie (2014):

"fixyourstreet.ie consists of a publicly accessible website with associated mobile technologies on which non-emergency issues such as graffiti, road defects, issues with street lighting, water leaks/drainage issues, and litter or illegal dumping can be reported."

The inspiration for "fixyourstreets.ie" came from the "fixmystreet.com" open source initiative that started in the UK and has spread around the world. There is a privately run site called "fixmystreet.ie" based on this open source platform which feeds into the LA run system.

Initially only issues related to South Dublin County Council were accepted. As of the 1st of January 2013, the site will accept reports for LAs nationwide. It is managed and maintained by South Dublin County Council. In addition to being an example of PPGIS it is a fine example of a shared service within the LA sector.

The service level agreement detailed in the programme for government requires that issues raised on "fixyourstreet.ie" are responded to within 2 working days by an official of the relevant LA.

4.4.2 Has "fixyourstreets.ie" been a success?

There is little or no objective feedback from the public available so a means of measuring the system's success was required. The review of the PPGIS literature identified trust as an important factor in the success of any PPGIS implementation. The public needed to be able to trust that any issues they report will be dealt with. To measure trust in the system, the quantity of issues logged year on year were compared. If the public do not trust the system then there should be a dramatic fall off in the number of issues reported as time passes.

Figure 4.18, figure 4.19 and figure 4.20 contain graphical representations of the "fixyourstreets.ie" data that was obtained from the public web service (section 3.4.3). It is clear to see from these graphs that there has not been a dramatic fall off in the number of incidents being logged in the system. The numbers are consistent and increasing slightly.

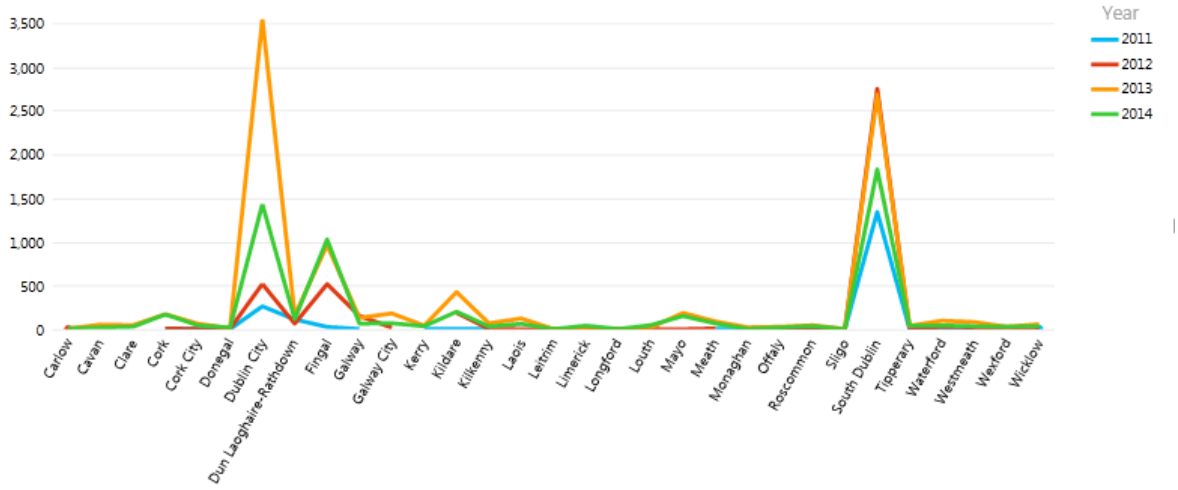


Figure 4.18: No. issues reported per LA per year

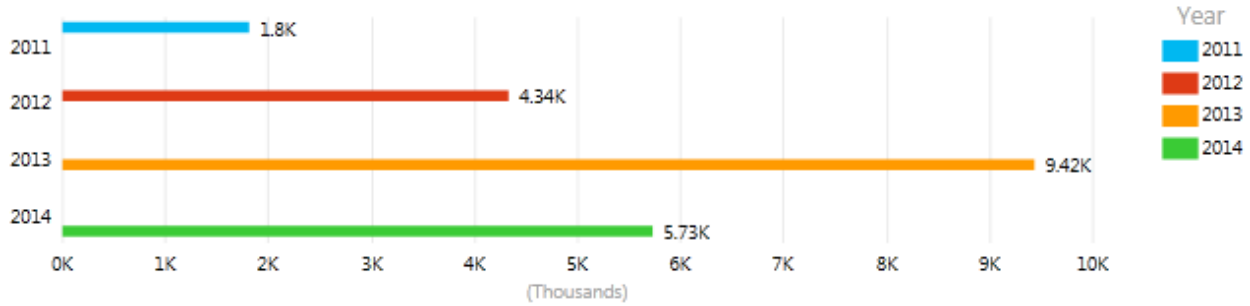


Figure 4.19: No. of issues reported per year

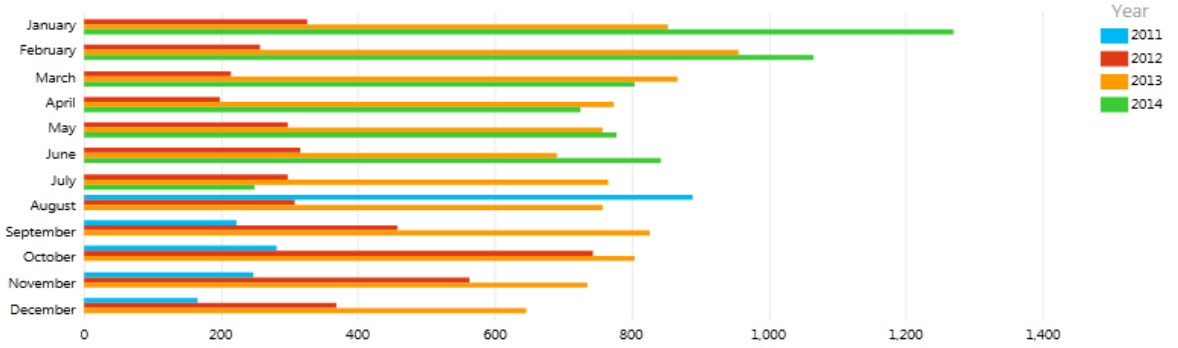


Figure 4.20: No. of issues per month per year

4.4.3 Local Authority Concern

The literature review highlighted a concern in government that should such a system be provided to the public that they will use it. This will generate an additional workload which could overburden the available resources. A review of the LA websites found that not all are promoting the use of “fixyourstreets.ie”. Some LAs such as Donegal and Dublin City have their own online mechanisms similar to “fixyourstreet.ie” for reporting issues but others rely on email or telephone. The unwillingness to promote this system suggests that this concern exists within some LAs. The interviewees had an alternative theory that it is

simply a lack of support or a different trepidation, the concern of accountability to the public which this system offers.

The analysis of the “fixyourstreet.ie” data suggests that this concern is unnecessary. Figure 4.21 displays the incidents logged in “fixyourstreet.ie” by LA since the 2nd of August 2011 to the 9th of July 2014. Until 1st of January 2013 only issues for South Dublin County Council were requested. The legend identifies LAs that direct citizens to “fixyourstreets.ie” (52%) from their website and those that do not (48%).

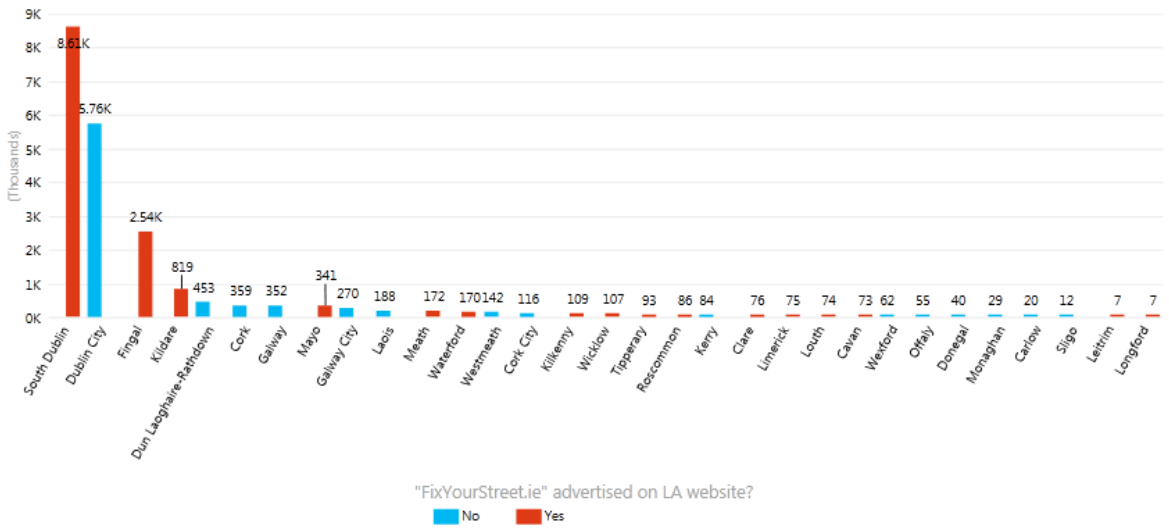


Figure 4.21: Incidents per local authority

It is clear that LAs that promote the “fixyourstreets.ie” are not burdened to any significant amount more than those that do not. They are however, reaping the benefits of a more efficient process to report issues in the community. The system allows for an efficient distribution of work because “fixyourstreet.ie” links the category of the issue e.g. graffiti, to a location meaning that all issues relating to graffiti within a particular area could be dealt with in a single project.

It was hoped that the data regarding the number of incidents logged in LAs via traditional means before the introduction of “fixyourstreet.ie” and after “fixyourstreet.ie” could be analysed and compared. However, attempts to access this information were unsuccessful. In the case of a single LA the report received which is based on anecdotal evidence suggests that 50% of reports were being logged via “fixyourstreet.ie”.

Once you have this geocoded data you can then map it and see the distribution of issues at any level from local to national (see figures 4.22 and 4.23).

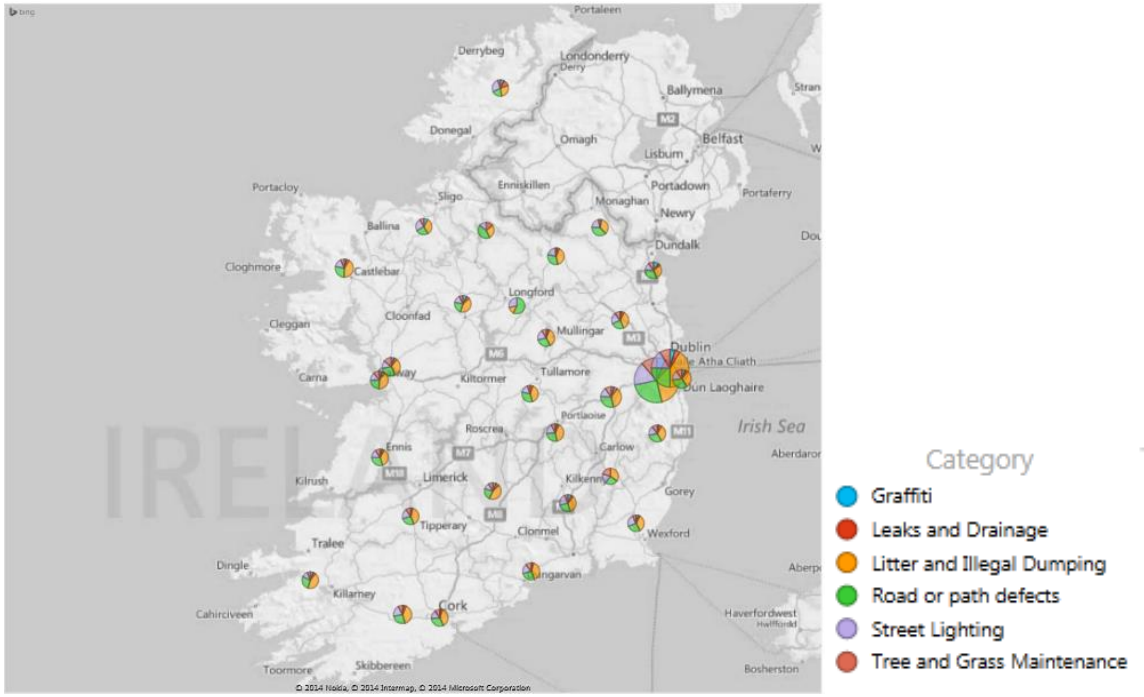


Figure 4.22: Count of “fixyourstreet.ie” incidents per local authority

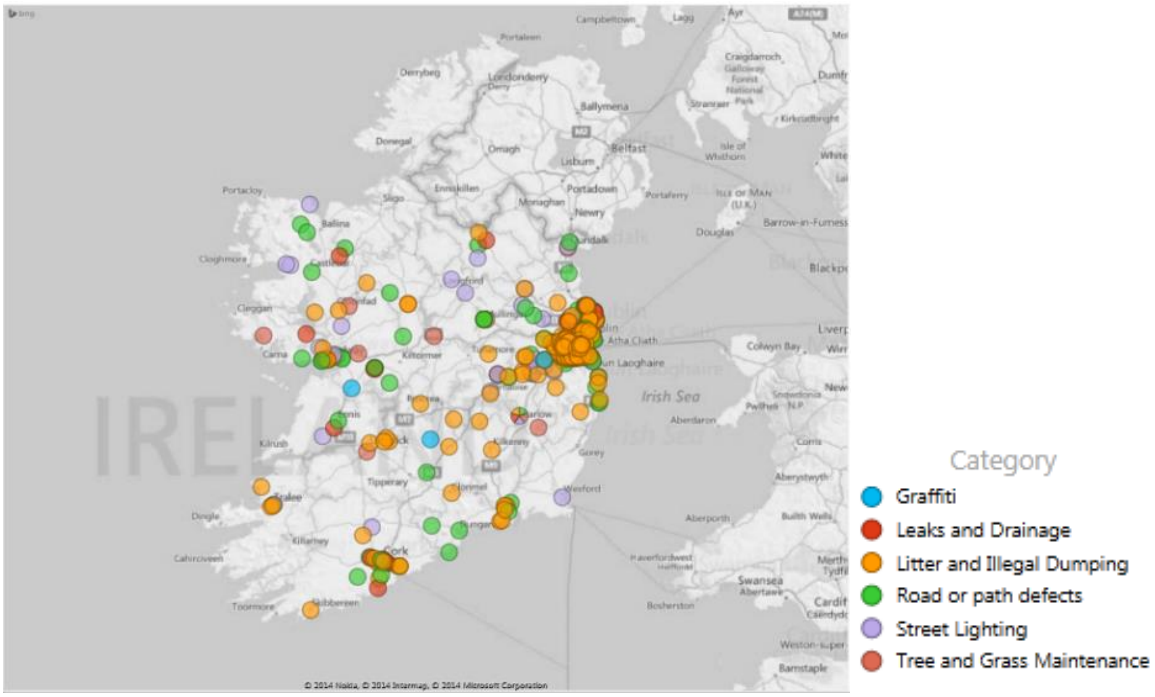


Figure 4.23: Sample of the distribution of individual incidents

The conclusions and anticipated future directions are detailed in Chapter 5.

5 Conclusions and Future Work

5.1 Introduction

This chapter contains the conclusions that can be drawn from the research findings. The generalisability of the research, interesting findings, limitations of the study and future directions are all reviewed.

5.2 Conclusions

Improved decision making is a significant benefit of eGovernment and the Irish government is actively pursuing a policy of eGovernment. The term PPGIS is an aspect of eGovernment which refers to a field of GIS that strives to improve public participation and nurture the empowerment of NGOs and local communities. Both the DEPR and DECLG are actively promoting the use of technology to improve the delivery of public services and increase the involvement of citizens in decision making. The extent to which PPGIS is used in Irish local government to accomplish these goals is unclear.

The aim of this study was to answer the following research questions:

- Are GISs primarily used to disseminate information to the public in Irish local government?
- Is there a demand to extend the use of PPGIS in Irish local government?
- What are the barriers to the utilisation of PPGIS in Irish local government?

This research shows that PPGIS while not without its challenges has the potential to play a significant role in Irish local government. By adopting the principles of PPGIS Irish local government would be following the example of Finland whose government has been a pioneer in terms of open government. The analysis of the quantitative and qualitative data gathered has shown that there is support for PPGIS in Irish LAs amongst the GIS Officers and staff. In the case of the PPGIS example “fixyourstreet.ie” used in this research, the data analysis has shown that the public are supporting the system even though there has been little or no marketing of the application since its launch.

In spite of the fact that this study has shown there is a demand amongst GIS Officers and staff for the extended use of PPGIS, the research has revealed that there are few implementations of PPGIS. There is no incentive to increase the level of “Public Participation” via GIS as it is extra work for already stretched resources. Currently, “fixyourstreet.ie” is the principle example of PPGIS in use in Irish local government however, 48% of LAs do not support it. The survey of LA websites showed that some LAs utilised GIS enabled reporting systems prior to the advent of “fixyourstreet.ie”. Digital

mapping has been used during the consultation phase in the development of LAPs in Fingal and Dún Laoghaire-Rathdown. The small number of PPGIS examples available proves that communication between county councils and the public via GIS is primarily to disseminate information.

There is support for PPGIS, but the use has been shown to be nominal. One of the objectives of this research was to identify the main barriers to the adoption of PPGIS in Irish local government. The principal barriers identified during the study are:

- Lack of leadership
- Concerns about data quality, i.e. non-expert data entered by the public
- Culture change
- Lack of available resources

Lack of leadership

Central and local leadership and drive were identified as important factors for the development of PPGIS, yet it is clear from the research that there is an absence of leadership where GIS is concerned. There is no central body responsible for the coordination, consultation on and promotion of GIS. There was no consensus on who should take the lead to promote PPGIS which highlights a potentially bigger issue. It suggests the absence of a central organisation to promote general ICT projects in Irish local government. The need for leadership and support from senior management was reflected in the interview responses. “fixyourstreets.ie” was highlighted as being successful because it was spearheaded from central government. One of the interviewees suggested that the GIS User Group should promote the use of PPGIS by creating feasibility studies and business cases These could then be presented at the various committees and forums in order to gain the support of senior management. Initiatives like PPGIS should be driven by the DECLG. It is essential that a leader is established or PPGIS use will continue to be nominal with no structured adoption.

Concerns about data quality

The survey showed that data quality is a significant concern to GIS Officers and staff. This was identified by one of the interviewees who made the point that for development plans accurate data is essential. Brown (2012b) and (Pocewicz et al., 2012) reflect these concerns however, Brown and Kyttä (2014) state that PPGIS studies that have been conducted to gauge the spatial accuracy of specific mapped attributes propose that a non-expert public can achieve reasonable accuracy. To address these concerns training

material should be good and easy to follow and a system of moderation should be implemented.

Culture change

The change in culture and the concerns about data quality are partially entwined. The change in culture will be three fold, firstly the public have more of an input into decision making, secondly, public servants will now be accountable and thirdly, the GIS expert will have to manage data entered by non-LA staff. The success of PPGIS hinges on the LA staff involved reacting positively to this culture change and changing their work practices accordingly. Strong leadership is required to make staff aware of the importance of democratising decision making.

Lack of available resources

The survey has shown that a significant barrier to the adoption of PPGIS is the lack of resources. This was backed up by each of the interviewees. The lack of resources ranges from the GIS level, to get the system up and running, to the administration staff and business area owners required to analyse and act upon the input from the public. Kahila and Kyttä (2009) identify inadequate resourcing as a factor in the reduction of effective participation in Finland. The literature and interviewee responses are clear. In order for a PPGIS initiative to be a success, it needs to be resourced sufficiently that public input is acted upon.

5.3 Generalisability of Findings

Generalisability describes the extent to which research findings are applicable to situations other than those in which they were initially verified. In terms of this research it is whether the findings may be applicable to any ICT project in government or an NGO.

The scope of the research was limited to Irish local government and the GIS Officers and staff in each LA. They were chosen to participate because they are the GIS experts in Irish local government. The intention of this research was to get the opinions, experiences and the state of Irish local government GIS from the local GIS experts because they were deemed to be best positioned and as Higgins (2012) found out these assets are not always considered when making decisions regarding GIS. The sample reflected this objective and can be considered representative.

The low number of interviewees reduces the extent to which conclusions can be drawn from this portion of the qualitative research. Nonetheless the interview data supported the survey results and reflected the findings from the literature review. The interviewees were

representative of County Councils and City Councils that provide differing levels of GIS services to the public. It is not possible to say whether they are representative of the entire sector however, the LA website review suggests that they might.

It is the belief that in spite of these challenges some of the research findings are generalisable. The literature review highlighted resourcing, lack of leadership and culture change as barriers to general ICT projects in organisations (Brown, 2012a, Mulgan and Albury, 2003). These were all identified in the survey and backed up in the follow-up interviews. In addition to this the survey and interviews highlighted the need for a central driving force or a local maverick to drive innovation. This too was highlighted in the literature by Brown (2012b).

5.4 New and interesting findings

This study is the first of its kind in Irish local government. Prior to this there have been surveys of GIS, e.g. Higgins (2012) but none that focused on the use of GIS to increase the level of “Public Participation” in planning and decision making.

There is a difference in opinion between technical and managerial GIS staff in terms of how GIS is perceived in LAs. The technical staff aren’t as convinced that GIS is perceived as a strategic tool and that enough is being done to achieve its potential.

It has been found that sophistication of GIS enabled services provided by LAs varies significantly. There is a desire amongst the GIS Officers and staff in LAs to expand the range of GIS enabled services to enable increased public participation however, there are significant barriers to overcome. These barriers include a lack of leadership/support from senior management and a lack of resources. The GIS Officers and staff spend so much time on operational duties and supporting business divisions that they do not have enough time to innovate.

There is support for a single GIS gateway. The issue that this would resolve was highlighted during one of the interviews. The case exists where an LA website publishes the location of a service that is in a particular location however, the same service could be available in another LA that would better suit a proportion of the public but they won’t find it as there is no cross boundary lookup available. This could be designed in such a way that each LA retained control of the data for its area however, control of the system and related infrastructure would be centralised.

GIS Officers and staff believe PPGIS could be used to identify potential planning conflict and for resolving existing conflicts. Kingston (2006) describes conflict resolution as a

primary aim of PPGIS. The interviewees had never seen GIS used to resolve a planning conflict however, one of the interviewees described how GIS is helping to prevent conflict between engineers and councillors as the engineers have the capability to log issues into the system in the presence of councillors via mobile devices.

GIS Officers and staff are not convinced that the public are ready for the devolution of the planning process to non-experts. This is significant because if this is representative of public opinion then Irish society may not be willing to accept PPGIS.

It was found that there is no objective public feedback available for “fixyourstreets.ie” and it would appear no analysis of the effectiveness of the system. “fixyourstreets.ie” is being supported by the public even though there has been little promotion. “fixyourstreets.ie” can geocode LA issues and as one of the interviewees pointed out, why shouldn’t management teams be sitting around a meeting with maps showing information on where things are happening?

Finally there is a lack of leadership and promotion for GIS and no consensus on who should fill this role.

5.5 Research limitations

This research reflects the views of the technical experts and managers who would be the people who deliver such a service and the people that have to deal with the public response/use of such a service. It might have been beneficial to broaden the scope of this research to include LA ICT managers, the senior managers in Irish local government and the public to get their perspectives. This could then have been compared against the expert opinions. However, the timeframe for the study was too short to accommodate this substantial increase in scope.

The slow response to the survey meant it was necessary to keep it open for longer which had knock on effects for the interviews. Six survey respondents volunteered for follow-up interview. Three interviews were conducted within the study timeframe. It would have been preferable to interview more GIS staff, however the overlap of the data gathering phase with the summer holidays, i.e. annual leave or extra workload, meant that this wasn’t possible.

It was not possible to gain access to the LA web service which contained the polygon data, i.e. council boundaries, which is used to distribute the incidents that are logged in “fixyourstreet.ie” to the relevant LA. This meant that an alternative method had to be

devised. This required additional workload, time and a potential for error. Sampling of the data suggests that the LA allocations are correct.

It was intended to retrieve data regarding the number of incidents logged by an LA via traditional methods, i.e. phone calls, emails, etc., before “fixyourstreet.ie” and after “fixyourstreet.ie” was established. A comparison of the data would show if “fixyourstreet.ie” was replacing traditional methods or simply another method for reporting issues. Access to this data could not be achieved.

5.6 Future Directions

There is support for the increase of “Public Participation” and thus PPGIS amongst the GIS Officers and staff. A number of LAs have already experimented with the use of digital mapping during the consultation phase of the development of Local Area Plans. The lack of leadership to promote PPGIS and the concerns about data quality need further investigation.

Further research might take these findings and survey the ICT managers, senior management and business divisions of LAs and compare the responses. A second direction might involve looking at the citizens who use such systems or indeed the general public. A third possibility would be a wide scale pilot of a PPGIS solution followed by a thorough evaluation. Brown and Kyttä (2014) suggest the use of PPGIS throughout a complete planning cycle. This would range from scoping to alternative development to decision making to monitoring. The evaluation is critical and would be a valuable piece of research because as Brown and Kyttä (2014) report there is a dearth of research on the evaluation of PPGIS in practice.

PPGIS in local government democratises decision making and ensures that councils are held accountable to the citizens they represent. This will become more important now that there is a local property tax and citizens will want to see the benefits of their contribution in the community. It needs strong local and central leadership and continual promotion.

Within Irish local government the expansion of GIS and its ancillary services is inevitable as the public desire for transparency of decision making and location of services and resources increases. There are very significant barriers for PPGIS to overcome however, it is essential that efforts are made to persist as the end result is a more democratic society.

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Appendices

Appendix 1 – Survey / Questionnaire

An Investigation into the Role of PPGIS in Irish Local Government

Consent for Participation in Study

LEAD RESEARCHER: Kieran Duane | duanek@tcd.ie or kduane@igma.ie | +353863809617

BACKGROUND OF RESEARCH: Improved decision making is perhaps the most promising element of eGovernment and the Irish Government is actively pursuing a policy of eGovernment. The term "Public Participation Geographic Information System (PPGIS)" is an aspect of eGovernment which refers to a field of geographic information systems (GIS) that seeks to enhance public participation and foster the empowerment of non-governmental organisations, grassroots groups and local communities.

Unlike GIS, which is used within an organisation for analytic and decision making processes, PPGIS transcends the boundaries of an organisation to involve citizens in collaborative mapping exercises and provide them with the use of GIS for individual or collective decision making processes. One way in which this is achieved is through the use of internet based GIS which enables two-way communication between the public and an organisation. In the case of this study the organisation is Irish local government. An example of PPGIS for reporting non-emergency issues to local councils is, "fixyourstreet.ie". However, the potential of PPGIS goes beyond this, it could be incorporated into the planning process to ensure citizens' views are considered and decision making is truly democratic.

I am inviting participants to complete an online survey. This survey is part of a research study which will seek to establish the current extent to which Public Participation Geographic Information Systems (PPGIS) are used in Irish local government, if there is a demand to extend the use of PPGIS in Irish local government and what are the barriers to the utilisation of PPGIS in Irish local government.

PROCEDURES OF THIS STUDY:
The survey will take approximately 10 minutes to complete. You have the right to omit individual responses without penalty and you have the right to withdraw at any time during the survey. The researcher would appreciate if all questions were answered. Please do not name third parties in any open text field of the survey. Any such replies will be anonymised. The information gathered in the survey will be analysed. All data gathered will be used anonymously in the analysis, publication and presentation of resulting data and findings. All names and email addresses collected for follow up interview are held in a separate section to the survey responses. The data gathered will be encrypted and stored securely. When the study is completed all survey responses will be deleted by 1st November 2014.

PUBLICATION:
A hardcopy of the final dissertation will remain in the Trinity College Library and a soft copy will be available from the course website where access will be restricted to masters students via a system of authentication. Should the dissertation be of the required standard it may be published in a third party journal. Individual results will be aggregated anonymously and research reported on aggregate results.

DECLARATION:
I am 18 years or older and am competent to provide consent.
I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
I understand that if I make illicit activities known, these will be reported to appropriate authorities.
I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
I understand that my participation is fully anonymous and that no personal details about me will be recorded.
I understand that if I or anyone in my family has a history of epilepsy then I am proceeding at my own risk.

***1. I agree to the terms and conditions detailed above.**

- ◯ Yes
- ◯ No

Statement of researcher's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

An Investigation into the Role of PPGIS in Irish Local Government

General GIS

2. How long are you in your current role?

- ○ 0-5 years
- ○ 5-10 years
- ○ 10-15 years
- ○ 15-20 years
- ○ More than 20 years

3. Which of the following best describes your role?

- ○ Technical
- ○ Managerial
- ○ Administrative

4. GOOGLE and Bing maps have raised GIS awareness and expertise amongst the general public to a level that they are now capable of using PPGIS.

Strongly disagree	Disagree	Agree	Strongly Agree
○	○	○	○

5. Regarding the GIS tools currently employed in your organisation, please tick all that apply. They are:

- ☐ Web-based
- ☐ Capable of two-way communication
- ☐ Have a user friendly design
- ☐ Intuitive to use
- ☐ None of the above

6. From the list below, select the types of interaction with the public that are currently achieved through GIS in your organisation. Tick all that apply.

- ☐ Information is provided to citizens
- ☐ Citizens are engaged via GIS enabled blogs, wikis, surveys or free form questionnaires
- ☐ Citizens are consulted, however they have no decision making powers
- ☐ Citizens are involved in decision making through votes or some other means

Other (please specify)

An Investigation into the Role of PPGIS in Irish Local Government

7. Please select any of the following local government service areas in your organisation which provide a GIS interface to the public. Tick all that apply.

- [ ] Agriculture, education, health or welfare
- [ ] Environmental protection
- [ ] Housing and building
- [ ] Libraries
- [ ] Roads and transport
- [ ] Planning and development
- [ ] Recreation and amenity
- [ ] Sanitation services
- [ ] Waste Water and sewerage
- [ ] Miscellaneous services, e.g. Maintenance of the Register of Electors.

Other (please specify)

An Investigation into the Role of PPGIS in Irish Local Government

Demand for PPGIS

8. Please rank the following list of PPGIS advantages for the CITIZEN in order of importance.

- Learn from government representatives
- Inform government representatives
- Get messages through to government
- Learn to participate in the community
- Engage government in discussion
- Influence the policy or implementation process
- Achieve better policy or implementation decisions

9. Please rank the following list of PPGIS advantages to GOVERNMENT in order of importance.

- Learn from citizens
- Inform citizens
- Engage citizens in co-creation
- Gain legitimacy of decisions
- Allay anxiety or hostility
- Avoid litigation costs
- Achieve better policy or implementation decisions

10. Spatial visualisation and analysis capacities inherent in GIS empower citizens to:

	Strongly disagree	Disagree	Agree	Strongly Agree
share local knowledge	○	○	○	○
prioritise issues	○	○	○	○
consider things from a location perspective	○	○	○	○
consider things from a population distribution perspective	○	○	○	○

11. PPGIS can be used by planners to gather and analyse public opinions to identify potential conflicts.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

An Investigation into the Role of PPGIS in Irish Local Government

12. Involving citizens and stakeholders in the planning process from the earliest possible opportunity IS NOT an important part of a democratic planning process.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

13. GIS is a planning tool with analytical capabilities and a public appeal that can be utilised to facilitate conflict resolution.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

14. Is Irish society ready to embrace the devolution of land use policy to non-expert audiences through public participatory GIS methods?

- ○ Yes
- ○ No
- ○ Don't know

An Investigation into the Role of PPGIS in Irish Local Government

Demand for PPGIS (Cont'd)

15. Increased public involvement in decision making is a key benefit of PPGIS.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

16. A GIS enabled discussion board or wiki would be useful to local authorities.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

17. In your organisation:

	Strongly disagree	Disagree	Agree	Strongly agree
GIS is seen as a strategic tool	○	○	○	○
There is limited support for GIS as a decision support system	○	○	○	○
There is an unwillingness to embrace the potential benefits of GIS	○	○	○	○

18. Increased public use of GIS would alert management to it's strategic potential.

Strongly disagree	Disagree	Agree	Strongly agree
○	○	○	○

19. Please rank the top 5 local authority service areas that you believe would most benefit from PPGIS.

- Agriculture, education, health or welfare
- Environmental protection
- Housing and building
- Libraries
- Roads and transport
- Planning and development
- Recreation and amenity
- Sanitation services
- Waste Water and sewerage
- Miscellaneous services, e.g. Maintenance of the Register of Electors.

An Investigation into the Role of PPGIS in Irish Local Government

Leadership, Unity and Direction

20. GIS Officers/Staff in Irish Local Government consider a major barrier to inter local authority GIS integration to be:

	Strongly disagree	Disagree	Agree	Strongly agree
the lack of data standards in the sector	○	○	○	○
the lack of technology standards in the sector	○	○	○	○

21. A single gateway to GIS data would provide a better service to the public.

○ Strongly disagree ○ Disagree ○ Agree ○ Strongly agree

22. Would you be willing for your PPGIS to be hosted by another Local Authority?

○ Yes
○ No
○ It would depend on circumstances and conditions

23. Rate the following factors in terms of their importance to the national adoption of PPGIS.

	Essential	Important	Not very important	Of no significance
Public demand	○	○	○	○
Funding	○	○	○	○
Current GIS technology	○	○	○	○
Local leadership and drive	○	○	○	○
Central leadership and drive	○	○	○	○

24. Who should take leadership for the promotion of PPGIS in Local Government? Please tick one box.

○ ICT Committee
○ LGMA
○ GIS User Group
○ County Managers (CCMA)
○ Department of the Environment, Community and Local Government
○ Department of an Taoiseach

Other (please specify)

An Investigation into the Role of PPGIS in Irish Local Government

Barriers to PPGIS

25. Please tick the 5 main barriers to the adoption of PPGIS from the following list.

- [ ] 1. Lack of leadership
- [ ] 2. Failure to engage staff
- [ ] 3. Poor project management
- [ ] 4. Affordability and unclear costs
- [ ] 5. Exclusion of citizens that are not computer literate or don't have access to a computer or the Internet
- [ ] 6. Technical issues such as legacy systems which do not allow two-way communication
- [ ] 7. Data protection issues
- [ ] 8. Culture change
- [ ] 9. Lack of stakeholder engagement
- [ ] 10. Lack of feasibility studies/business case development
- [ ] 11. Risks involved
- [ ] 12. Organisational structure
- [ ] 13. Lack of available resources
- [ ] 14. Concerns about security
- [ ] 15. Concerns about privacy
- [ ] 16. Concerns about data quality, i.e. non-expert data entered by the public
- [ ] 17. Lack of incentives or rewards for adopting innovation
- [ ] 18. Short term budgeting and planning horizons
- [ ] 19. Concerns about not being able to handle the additional workload created by PPGIS

20. Other (please specify)

26. Of the 5 barriers you selected in question 25, rank the top 3 in order of importance. Please note that you only need to write the barrier number, e.g. 11 for Risks involved.

27. Do you have any other comments or observations on the use of PPGIS?

An Investigation into the Role of PPGIS in Irish Local Government

28. Would you be willing to be interviewed? If so, please enter your email address below.

Note: email addresses will not be stored with the rest of the response data.

***29. Thank you for taking the time to come this far! You have reached the end of the survey, do you want to submit your responses?**

- ◯ Submit
- ◯ Exit without submitting

Appendix 2 – Local Authority Website Survey Table

Local Authority	Public GIS Map/s?	Two-way?	Fixyourstreets link on home page	gPlan?	other	Service
Carlow County Council	Yes	No	No	Yes		Planning
Cavan County Council	Yes	No	No	Yes		Planning
Clare County Council	Yes	No	Yes	Yes		Planning
Cork County Council	Yes	No	No	No	Yes	Planning
Donegal County Council	Yes	No	No (Appear to have own system. Login in via mobile phone pin)	Yes		Planning
Dún Laoghaire-Rathdown	No – public map	No	No	No		
Fingal County Council	Yes	No	Yes	No	Yes	Planning
Galway County Council	Yes	No	No	No	Yes	Planning
Kerry County Council	Yes	No	No	No	Yes	Planning
Kildare County Council	Yes	No	Yes	No	Yes	Planning
Kilkenny County Council	Yes	No	Yes	No	Yes	Planning, Interactive Mapping Application, Census Mapping and Statistics, Co. Co. Location Map, Google Maps Applications, Townlands GIS/Mapping Application & Tree Register of Ireland Survey
Laois County Council	Yes	No	No	Yes		Planning
Leitrim County Council	Yes	No	Yes	No	Yes	Planning, general information and census data.
Longford County Council	Yes	No	Yes	Yes		Planning
Louth County Council	Yes	No	Yes	Yes		Planning
Mayo County Council	Yes	No	Yes	No	Yes	Planning
Meath County Council	Yes	No	Yes	No	Yes	Planning, water quality
Monaghan County Council	Yes	No	No	Yes		Planning
Offaly County Council	Yes	No	No	Yes	Yes	Planning, etc.
Roscommon County Council	Yes	No	Yes	Yes		Planning, Development Plans, Map portal which contains information on L.A. services such as heritage, tourism, etc.
Sligo County Council	Yes	No	No	No		Planning
South Dublin County Council	Yes	Yes (Report an issue)	Yes	No	Yes	Planning
Tipperary County Council	Yes	Yes (report an issue)	Yes	No	Yes	Planning, Environmental complaints.
Westmeath County Council	Yes	No	Yes	Yes		General info and planning.
Wexford County Council	Yes	No	No	No	Yes	Planning
Wicklow County Council	Yes	No	Yes	Yes	Yes	Planning, census and general data.
Cork City Council	Yes	No	No	No	Yes	Planning
Dublin City Council	Yes	Yes (Report an issue)	No (Have similar local system)	No		Planning and report an issue
Galway City Council	Yes	No	No	No	Yes	Planning and various other maps
Limerick County Council	Yes	No	Yes	No	Yes	Planning, etc.
Waterford City & County Council	Yes	No	Yes	No	Yes	Planning and a variety of general services are displayed on the map.