Dublin's Place in the Irish and Global Economy 2012

Report 1

Prepared for Dublin Regional Authority

COLLATING AND ASSESSING THE AVAILABILITY AND APPLICABILITY OF SOCIO-ECONOMIC DATA AND INFORMATION RELATING TO DEVELOPMENT OF THE DUBLIN REGION

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Abbreviations

AIRO	All Island Research Observatory
ASI	Annual Services Inquiry
CBCS	Census of Building and Construction Survey
CLC	CORINE Land Cover
COPSAR	Census of Population Sample of Anonymised Records
CORINE	Coordination of Information on the Environment
CRO	Companies Registration Office
CSO	Central Statistics Office
DECLG	Department of the Environment, Community & Local Government
DES	Department of Education and Skills
DRA	Dublin Regional Authority
ED	Electoral Division
EI	Enterprise Ireland
EPA	Environmental Protection Agency
ES	Eurostudent Survey
ESPON	European Observation Network for Territorial Development and Cohesion
ESRI	Economic and Social Research Institute
GB	Great Britain
GDA	Greater Dublin Area
GDR	Greater Dublin Region
GIS	Geographic Information System
GVA	Gross Value Added
HBS	Household Budget Survey
HEA	Higher Education Authority
INSPIRE	INfrastructure for SPatial InfoRmation in Europe
ISSDA	Irish Social Science Data Archive
ISSP	Irish Social Science Platform
LA	Local Authority
LFS	Labour Force Survey
LR	Live Register
MOLAND	Monitoring Urban Land Cover Dynamics
NCG	National Centre for Geo-computation
NIRSA	National Institute for Regional and Spatial Analysis
NSB	National Statistics Board
NSHQ	National Survey of Housing Quality
NTA	National Transport Authority
NTS	National Travel Survey
NUI	National University of Ireland
NUTS	Nomenclature of Territorial Units for Statistics
OPW	Office of Public Works
OSi	Ordinance Survey Ireland
POWSAR	Place of Work Sample of Anonymised Records
POWCAR	Place of Work Census of Anonymised Records
PRTLI	Programme for Research in Third Level Institutions
QNHS	Quarterly National Household Survey
RIKS	Research Institute for Knowledge Systems
RoI	Republic of Ireland
SAPS	Small Area Population Statistics
SILC	Survey on Income and Living Conditions
SME	Small and medium enterprises
UCD	University College Dublin
UEP	Urban Environment Project

EXECUTIVE SUMMARY

Introduction

The overall study titled “Dublin’s Place in the Irish and Global Economy 2012 was commissioned by the Dublin Regional Authority on behalf of the Dublin Local Authorities. The purpose of this study is primarily to ascertain Dublin’s performance in economic terms in the current fiscal climate, to benchmark this performance both at national and global scales. This will assist in providing recommendations which will improve city region functioning and to provide an evidence base of research to support investment within the functional city region and nationally which will maximise national economic output and provide a pathway for national sustainable development.

This study intends to form the basis and provide a platform for further research which can be utilised by policy makers at local and central government to inform their decisions. Realising the need to provide clear policy direction for the Dublin city region which is embedded in national economic interests, it draws together a multitude of data and information being processed across national, regional and local agencies and organisations both within the private and public sectors. This latter element represents a significant advancement in evidence based research in that this study rather than replicating previous research and reports carried out in this area will build a structured network of data and information from both interrelated and previously disparate sources.

The expectation is that by demonstrating the value of collating and assessing various datasets, information sources and contemporary opinion a transformation model for more effective planning and decision making will evolve.

In terms of this context for the overall study the following suite of initial objectives have been identified:

- To ascertain and determine the extent to which the Dublin city region is the driver of the national economy both nationally and in a global context. The study will examine, using the broad spectrum evidence base the degree of interdependence between the Dublin city region and (i) its functional area and administrative hinterland (defined as the Mid-East NUTS3 region), (ii) the rest of the Country, and (iii) globally (including development and economic links along the Dublin-Belfast corridor).

- To determine where Dublin can enhance economic development (areas of high growth potential) and to assist in a longer term sustainable development strategy which aligns National and Dublin city region interests.

- To analyse effective investment strategies for Dublin and to demonstrate through evidence based research optimal location for investment in terms of broad infrastructure provision, employment capacities, demographic trends, sustainable development patterns, and so forth. This will be achieved through cluster analysis and opportunity mapping based on the data layers collated from across regional and state agencies. Advanced urban and regional modelling and analysis techniques including the EU developed MOLAND[1] model will be used as part of this research.

[1] Monitoring Land Use Dynamics (http://moland.jrc.ec.europa.eu)

- To explore and build an evidence base for Dublin in the context of its position as a global hub for innovation, creativity, business and research.

- To build on and align with past and current research at all levels including within the local authorities of the city region. To utilise international and sustainable development benchmarking, the range of data resources, various reports and on-going initiatives from the city and county councils (i.e *City Identity Project* and *Dublinked*), national reports and other information and data from regional and State bodies to build an analytical perspective on city functioning in the national context.

In this regard Report 1 *"Collating and Assessing the Availability and Applicability of Socio-Economic Data and Information Relating to Development of the Dublin Region"* was developed. The purpose of this report is to carry out a review of the data sources and available datasets relating to the socio-economic development of Republic of Ireland (RoI) in general and of the Dublin region in particular, over the past two decades. The datasets were assessed with a specific focus on their applicability in spatial and temporal analysis. The reports and datasets are not exhaustive and new and updated information and data will become available over the course of 2012. These will be introduced and integrated into Report 1 and the overall study where relevant.

Deliverables:

- **Report 1 (January 2012)** will group and analyse the wealth of quantitative evidence available on a regional basis relevant to the study aims and objectives. It will lay the building blocks for business, demographic and economic analysis with spatial outputs. It will collate the data of the Local Authorities, CSO (Central Statistics Office), Dublin City Council (DCC), ESRI, NTA (National Transport Agency), FORFAS, IDA, the Universities and Institutes, and other relevant sources.

- **Report 2 (March 2012)** will specifically examine business sector activities in terms of location; and the relationships between business locations and types in terms of traditional sectors, emerging growth sectors and the knowledge economy. It will query CSO, GeoDirectory, CORINE, FDI, IDA and related datasets as available. Report 2 will outline specifically where datasets have been combined, reprocessed, analysed and where added value to research in this area has been realised.

- Regarding Reports 1 and 2, all collected datasets will be imported and combined in a geodatabase and integrated with the GIS maps created during the project. This is intended to be a valuable new resource for research in this area.

- **Report 3 (June 2012)** will focus on the qualitative elements of the research including an extensive literature review, the analysis of interviews and focus group materials identifying key policy issues, potential responses and future scenarios for development. It will also incorporate commentary and analysis taken from Reports 1 and 2 examining trends on knowledge economy and competitiveness data such as employment trends, live register trends, innovation statistics and other relevant datasets and information holdings.

- **Report 4 (Sept/Oct 2012)** will develop a synthesis of key policy issues, approaches and contain recommendations of future policy directions.

Summary of Key Recommendations

"Collating and Assessing the Availability and Applicability of Socio-Economic Data and Information Relating to Development of the Dublin Region"

- The analysis of datasets and the collation of additional primary research data will be used in the preparation of analytical reports on the future role of Dublin. It is recommended to engage with stakeholders in both the public and private sectors so as to collate metadata and spatial data and develop complementary portals for the presentation, matching and sharing of these data. To align and cross-reference multiple datasets from across the city region within the scope of carrying out bespoke socio-economic analysis of the Dublin city region within national and global contexts.
- To similarly utilise the data collated to show the interconnectedness and economic linkages between the Dublin city region, its wider hinterland and the State.
- To build a legacy through this study which incorporates the establishment of a technical working group taken from academia, the public and private sectors and a wider community of practice across sectors for the purposes of data share and the development of streamlined guidance for and appliance of urban scale analysis.
- To utilise existing and new applications (for example, opportunity mapping of employment and liveability through GIS) and joined up datasets to develop evidence informed policy making in the field of the socio-economic and functional planning of the city region. The benefits of GIS application to policy formation should be supported at all levels and demonstrated and used wherever possible.
- To lobby to develop greater harmonisation of data coding and to ensure data are provided at a level of disaggregation which will adequately inform policy formation. In this regard, standardisation of the industrial categorisation as well as geographic location identifiers used in different databases is necessary to make them compatible and allow combined analysis of various datasets.
- To re-affirm the need for a standard geo-spatial coding system and demonstrate the practical benefits of doing this in the context of providing an evidence base for macro and micro economic analysis of a metropolitan city region.
- To complement existing initiatives from the EU down to a local level such as the INSPIRE Directive and Dublinked[1] and the work of AIRO[2] (All Island Research Observatory) respectively and to build formal arrangements for data share to eliminate duplication of work and assist the standardisation of datasets.

[1] www.dublinked.ie

[2] http://www.airo.ie/

Structure of the Report 1

Report 1 is largely reflective of a preliminary data gathering and analysis exercise. The data collated will be used to provide an evidence base for further quantitative analysis and qualitative assessment, commentary and recommendations. A decision was made to gather the quantitative evidence base at the outset of the project as this type of exercise can very often be time consuming and resource intensive. However, it is clearly recognised that the data sources and datasets are not time limited and in some cases will change over the duration of the project. Any alterations or releases will be reflected in the final iteration of this report and the associated synthesis report later in 2012.

Another rationale for collating data at the outset was to permit a full assessment of the various data types technically, temporally and spatially. A lack of coordination of data collection and information sharing across agencies results in datasets which are not readily comparable. This is because these data may be collected and reported at different times and over different reporting periods, in different formats and according to different standards, and at various levels of spatial (dis)aggregation (point level, electoral district, local authority, NUTS2 and NUTS3). Moreover, in some instances address point data are geo-coded whilst in others they are not and geo-coding may need to be rationalised.

It is also important to note the variety of data sources which in conjunction with the spread of data types and configurations necessitates standardisation of the data. The advantage of bringing these data together onto one system for the purposes of this study is considerable. The exercise will result in consensus building and alignment of datasets as well as building relationships between data holders across sectors and agencies through a common focus.

This will result in a better and shared understanding of the economic geography of the country and produce recommendations to expand the knowledge base as well as providing improved understanding of complex social and business interactions and relationships. It will furthermore assess these socio-economic interactions within the scope of the national economic base and relative to global trends and benchmarks. Multi-layered data ranging across infrastructure (education, health, utilities retail, residential etc), mobility, industry clusters, R&D data, demographics will be analysed and result in opportunity mapping. This will lead to the identification of sectoral clustering and evidence based recommendations for improved spatial planning and economic functioning.

The Introduction in Section 1 of this report is followed by Section 2 describing available socio-economic and other relevant datasets. Their compatibility is outlined considering geographic and temporal resolutions as well as sectoral classifications used. A few long term and on-going projects which are relevant to the scope of this study such as Dublinked, StatCentral, the All Island Research Observatory (AIRO), and others are also described.

Section 3 discusses a number of potential new applications of the available datasets. A number of data sets have been sourced from the different agencies and organisations; and are currently being standardised for use within the scope of the study. The output of this exercise will be delivered in Report 2. While not all data are suitable for in-depth spatial analysis the research team will endeavour to report as comprehensively as possible on the interrelationships between these data and the potential to create a powerful decision support system by combining and analysing various socio-economic, transport, infrastructure and environmental datasets in GIS and modelling applications.

When data are matched at location point or Electoral Division across multiple datasets the potential to carry out advanced geo-spatial analysis can be realised. In terms of delivering practical output, analysis of these data will permit cluster spatial analysis to identify priority or

hot spots of specific business sector activity and to determine both nationally and within the Greater Dublin Area where business types are most or least prevalent. By inputting employment data across the broad economic sectors of commerce, industry and public/private services land use model MOLAND is able to predict changes to land use which may occur over the next 20-30 years and further assist planning and economic development decisions. Policy makers will be afforded a powerful decision making tool to identify specific locations for industrial and commercial activities. Moreover, combining health, transport, education and employment data realises the potential to carry out opportunity mapping, that is, the identification of areas in proximity (or not) to opportunity for employment and quality services. Comprehensive opportunity maps can be created to display the composite of many indicators linked to quality of life and attractiveness for investment, education and employment.

Finally, Section 4 provides recommendations on improvement of datasets and data sharing for more effective in-depth spatial and temporal analysis.

The Appendices provide more detailed information about data sources (Appendix A), available datasets (Appendix B), different classification systems (Appendices C-H) as well as about some benchmark studies (Appendix I). Particularly:

- Appendix A describes the primary data sources and their general limitations. These include but are not limited to: Central Statistics Office; Economic and Social Research Institute; Ordinance Survey Ireland; Irish Social Science Data Archive; National Transport Authority; Environmental Protection Agency; Department of the Environment, Community & Local Government; Department of Education and Skills; Department of Social Protection; Higher Education Authority; Health Service Executive; Forfas; Enterprise Ireland; IDA Ireland; Companies Registration Office; Office of Public Works.
- Appendix B presents numerous datasets identified for consideration. These include CSO databases such as Place of Work Census of Anonymised Records, Small Area Population Statistics, the Census of Industrial Production and other databases such as the An Post GeoDirectory of residential and business addresses, the FAME business directory, NTA transport and mobility data and a suite of other social and economic datasets.
- Appendices C, D, E, F and H present various classification systems used in different datasets.
- Appendix I describes broad level categories of some benchmark studies.

In summary Report 1 is a compendium of data collated to date. Behind this report are numerous datasets from various sources and covering a multitude of sectoral interests. Report 1 also points up data limitations and opportunities to improve and rationalise how we collate data, share data, update data. It also raises questions regarding the usefulness of data currently available, in terms of the relevance of the spatial units it is disaggregated to. Gaps in economic data at county/local authority level represent one area where more detailed data would contribute greatly to the evidence base for future decision making, for example. Nevertheless, by gathering these data together already a greater awareness of the depth and usefulness of these multiple datasets has been demonstrated.

Research Team and Roles

Within this organisational structure a team of researchers have been assigned to complete the work set out.

- Director, DRA – Overall co-ordinator on behalf of the Dublin local Authorities
- Dr. Brendan William, UCD – Principal Project Researcher
- Dr. Harutyun Shahumyan, UCD – Quantitative Data Analyst
- Dr. Walter Foley – Qualitative Data Analyst
- Mr. Jamie Cudden, DCC - Research Manager,
- Ms. Eugenia Thompson, DRA - Senior Research Officer (provides additional support)
- Steering Group

The Director of the DRA will act as the overall project coordinator with responsibility for delivery of the synthesis report. The Director will inform the City and County Managers of the progression of the study throughout the reporting period of 2012.

Dr. Brendan Williams with his team consisting Dr. Harutyun Shahumyan and Dr. Walter Foley will provide academic rigour and objectiveness to this study. The latter researchers will carry out quantitative and qualitative data analysis and assessment, respectively.

Dr. Harutyun Shahumyan is an expert in GIS and data analysis. He has been centrally involved in the adaptation and application of the EC Joint Research Centre land use model MOLAND for the Greater Dublin Region. In 2009 and 2010 as part of his work in the UEP team he developed four land-use scenarios for the Regional Planning Guidelines 2010-2022 which modelled the likely land-use and settlement patterns of business-as-usual and sustainable development scenarios of urban development across the GDA. Dr. Shahumyan is responsible for the delivery of Report 1 and 2.

Dr. Walter Foley worked from 2007-2011 as a research officer in the Dublin Regional Authority with responsibility for delivery of special projects and central elements of the Regional Planning Guidelines for the GDA 2010-2022. Prior to this he completed a PhD on Sustainability and Future Settlement Patterns across 3 study clusters in Ireland, namely the Mid-West Region, the Midlands and the North-West. He has extensive experience of data collation and analysis of sustainable development indicator data. Dr. Foley will be responsible for the delivery of Reports 3 and 4 and the completion of the synthesis report.

Jamie Cudden is a Researcher based in the Economic Development Unit (EDU) in Dublin City Council. He is currently working on and assisting the development of the Dublin Identity and Branding Project. In this regard his work is very closely aligned to the study. Developing a recognisable and workable brand and identity for the city is an inherent part of ensuring that the city is maximising its economic viability and contribution to national economic recovery, enhancing its reputation as a global hub of investment innovation and creativity, a tourist destination and so forth. He is also responsible for numerous research and initiatives in recent years, most notably the '*Your Dublin, Your Voice'* citizen engagement panel and carrying out extensive and detailed benchmarking and data collation in the area of economic and sustainable development indicators. He will work alongside the quantitative and qualitative researchers in UCD in the development of all four reports and the final synthesis reports. As part of a wider collaborative action involving the identity project he will in conjunction with Walter Foley carry out interviews with key stakeholders in the main public and private sectors.

Eugenia Thompson is the Senior Research Officer in the Dublin Regional Authority. She has responsibility for special projects including 1) indicator development for monitoring and implementation of the Regional Planning Guidelines and 2) Territorial Performance Monitoring – an ESPON project which is benchmarking the region and being led by the All-Ireland Research Observatory (AIRO), NUI Maynooth. She will provide technical assistance, advice and support throughout the duration of the project providing a research bridge between the Director of the DRA and UCD research team.

1. INTRODUCTION

This report is intended to address the lack of co-ordination of data and information across agencies involved in regional development issues across the Dublin region. It recognises that there are serious limitations in the quality of data and only limited efforts historically at standardisations of datasets as information was often originally collated by individual state agencies for limited purposes. The integration and standardisation of such data sets offers significant opportunities to better understand the economic geography of the region and understand the complex interaction between population demographics, social economic development that occurred over the past 20 years. Such analysis will assist and inform policy making and the future social and economic development of the region.

1.1 Purpose

The objective of this report (Report 1) was to carry out a review of the data sources and available datasets relating to the socio-economic development of Republic of Ireland (RoI) in general and of the Dublin region in particular, over the past two decades. The datasets were assessed with a specific focus on their applicability in spatial and temporal analysis. The prospects of linking or combining different databases to increase their overall analytical potential were considered.

Along with the main official and public sources of socio-economic data a number of relevant recent studies and research projects were also reviewed and are briefly presented in the report. The data sources and studies reported herein do not represent an exhaustive list. Over the time period of this project it is expected that new sources will be uncovered or indeed developed which may be of relevance to certain elements of the overall study. As this occurs these datasets and their relevance will be incorporated in to Report 1.

The purpose of this report was to increase awareness of the available data resources, related research and findings, prevent duplication of efforts and create solid base of knowledge for future research.

Based on the availability and characteristics of the reviewed datasets and taking into consideration earlier research, innovative approaches are suggested to support policy makers and planners in applying evidence-based decision making. These approaches are intended to be applied in the later stages of the project following the publication of this initial report.

1.2 Background

This National Spatial Strategy for Ireland (NSS, 2002) (which is being considered for review in 2012) is a twenty year planning framework designed to achieve a better balance of social, economic, physical development and population growth between regions. It is the overarching policy document within the tiered planning structure of the State. The strategy emphasises continued strong growth in the Greater Dublin Area (GDA)[1] but with significant balanced development in the regions outside the capital and more particularly in the nine gateway cities and nine hub towns (Figure 1-1). Balanced regional development is defined as “developing the full potential of each area to contribute to the optimal performance of the state as a whole – economically, socially and environmentally” (NSS, 2002 page 11). It was supposed that this will result in the rate at which the GDA is increasing its national share of population lessening; while other regions’ share will start to increase. The fundamental approach of the NSS is to

[1] GDA is constituted by the Dublin and Mid-East Regional Authorities.

encourage greater spatial balance by strengthening areas and places in a structured way, rather than seeking to stop growth in Dublin.

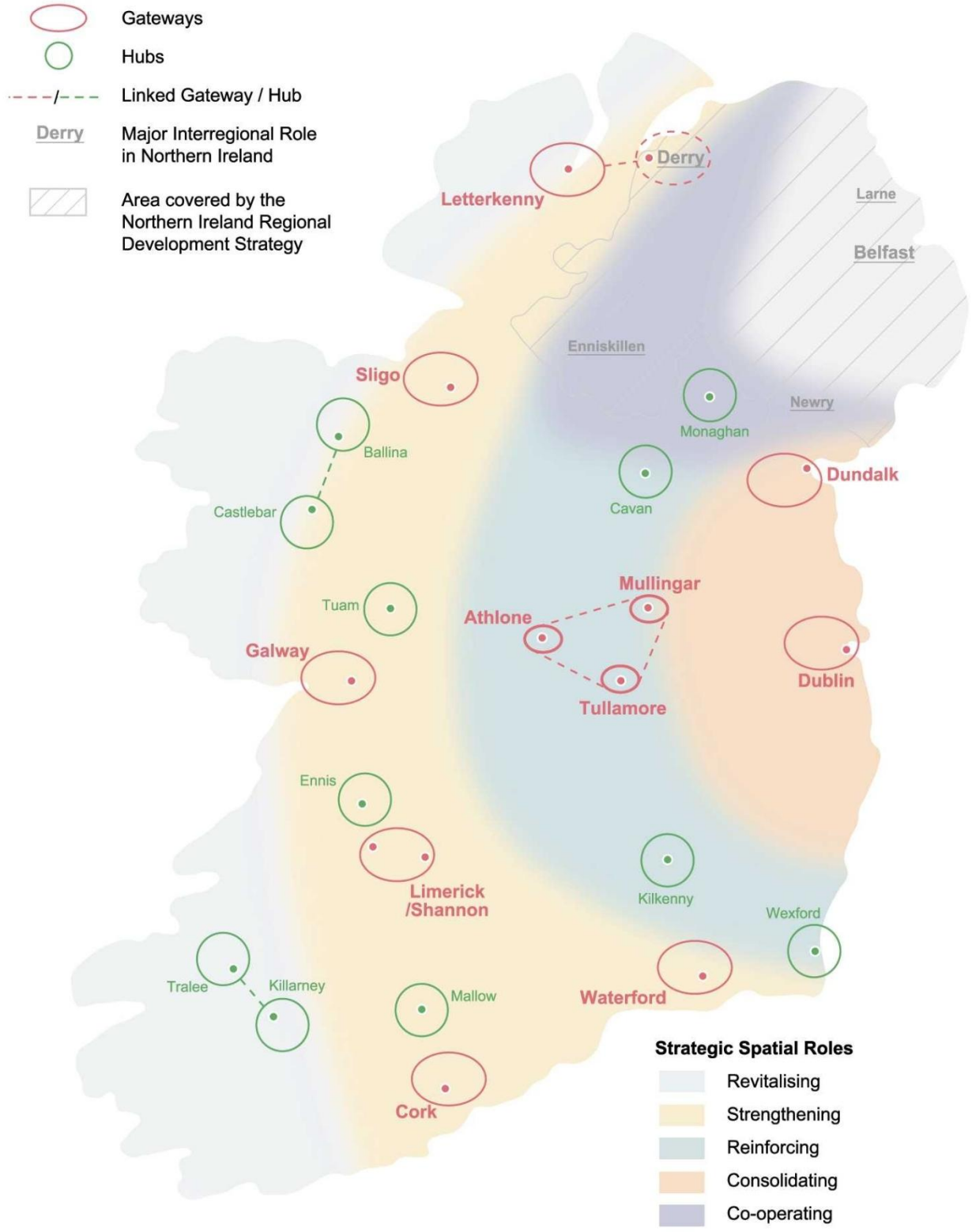

Figure 1-1: Gateways and hubs indicated in NSS (2002)

The second planning tier is the Regional Planning Guidelines (RPGs) which works to implement the strategic planning framework set out in the NSS (D&MERA, 2010). It achieves this through appraisal of the critical elements involved in ensuring sustainable and good planning, and though the protection of sensitive and environmentally important locations. The first RPGs for the GDA were adopted in 2004 and set out a strategic framework for planning and development

for the region up to 2016. Then they were reviewed in 2010 (D&MERA, 2010) updating the 2004 document and developing plans to 2022.

However, the realities of recent development patterns differ substantially from stated policy in the NSS and from international best practice in many cases. The evolving urban form and development trends require examination in order to identify the implications for sustainable development policy aspirations.

The significant change to economic growth, employment levels and public finances are the most critical issue in implementing the updated RPGs for 2010-2022. Future investment by the State and various public bodies will need to be more integrated, achieve much greater efficiencies and serve the areas most in need of investment. The clear linking of the future locations of growth with investment in public infrastructure, and the focused supply of new population growth directly linked to large-scale public transport investment is critical in an era of reduced public finances and diminished housing activity.

A key part of developing the Settlement Strategy and the Strategic Environmental Assessment (SEA) of the RPGs was the examination of alternatives of settlement pattern planning approaches. The process of developing the new Strategy was explored through a modelling exercise, using the European Commission Joint Research Centre's MOLAND[1] model. As part of the Urban Environment Project (UEP) at University College Dublin (UCD) the MOLAND model was applied to model the impact of different policy approaches to accommodating growth in the Greater Dublin Region (GDR)[2] (Brennan et al, 2009). The advantages of using a model such as MOLAND is that it provides a visual strategic appraisal of future change and growth within the region, so that impact of strategic approaches can be evaluated and assessed in evidence based form.

The RPGs recognise the importance of sharing of Geographic Information System (GIS) databases between local authorities. It recommends local authorities to avail of GIS data from external organisations such as geo-referenced listings of tourism, health, education, accommodation and features where it is made available; and to share and combine these data. Local authorities within the Dublin region have made significant progress in recent years in terms of GIS mapping of services and other relevant data. One of the most recent examples is the Dublinked initiative[3], described in section 2.4.

The RPGs indicated also that land use and transport are priority policy areas that need to be integrated to better realise economic success, environmental protection and quality of life. The integration of investment in transport with housing, business, and leisure locations is essential to achieve efficiency from investment by the Government in public transport. The Government launched Transport 21[4] in 2006 which sets the form of State investment in public transport up to 2015. The completion of such projects would bring significantly improved public transport to areas of the GDA and to the City Centre. However, due to the economic recession Transport 21 was superseded by the new National Development Plan from 2012 with reduced and delayed levels of implementation.

Clarity of investment in public transport is critical and following public consultation in 2011, the National Transport Authority (NTA) prepared a final draft of a new transport Strategy for the

[1] http://moland.jrc.ec.europa.eu

[2] The MOLAND study area named Greater Dublin Region (GDR) is of similar, though not identical extent to the Greater Dublin Area (GDA): the GDA consists of the Dublin, Meath, Kildare, and Wicklow counties; while in addition to these the GDR includes also Louth County.

[3] http://www.dublinked.ie

[4] http://www.transport21.ie

GDA - 2030 Vision (NTA, 2011). Its role is to establish appropriate policies and transport measures that will support the GDA in meeting its potential, as a competitive, sustainable city-region with a good quality of life. The appraisal of options was supported and informed by extensive modelling analysis undertaken using the Authority's multi-modal, strategic transport model for the GDA described in section 2.4.

The applications of the models for developing evidence based policy documents in Dublin and across Ireland demonstrate a growing understanding of the need to apply innovative approaches to real world planning.

1.3 INSPIRE Directive

INSPIRE (INfrastructure for SPatial InfoRmation in Europe) is a Directive of the European Union concerning the establishment of an Infrastructure for Spatial Information (Directive 2007/2/EC).

The Directive recognises the need to better coordinate information and data between users so that information and knowledge from different sectors can be combined. These data are related to the environment and Member States are obliged to create metadata in this area and following this a network of services for the public to access and use these data subject to conditions. Network services make it possible to discover, transform, view and download spatial datasets. The All Ireland Research Observatory (AIRO) is a good national level example of network service in action. Similarly, Dublinked is an open data resource which highlights how public services can make their data available and usable (in the latter case with potential for the promotion of eCommerce)[1].

INSPIRE will, moreover, create a geo-portal at Community level and each Member State will work towards the facilitation of sharing and linking of spatial datasets between public authorities. Creating infrastructures for harmonisation and sharing of data is intended to assist policy-making in the area of policies and activities that may have a direct impact on the environment.

Of interest is that the INSPIRE Directive has been developed for well over a decade now and is to be fully implemented by 2014.

While the DPIGE study primarily assesses economic data the challenges, procedures and targets for INSPIRE reflect on a more strategic and global level similar aspirations for data standardisation and linkage. Of particular relevance is the direction given to ensure that spatial data can be shared and that there is interoperability between datasets to assist formulation and monitoring of the effectiveness of legislation.

In addition, many of the data due to be mapped by, or of interest to DPIGE, such as buildings by sector, land use, transport infrastructure, human health and health infrastructure, production and industrial facilities, utility and government services are either covered under INSPIRE or are indirectly related to environmental impact.

Report 1 of DPIGE demonstrates the need not only to harmonise environmental data but also the need and potential of harmonising data cross-sectorally. In this regard it is a useful exercise for future proponents of the INSPIRE Directive to take note and account of.

[1] These and other relevant initiatives are described in more details in Section 2.3 of this report.

1.4 Innovative Use of Data in Decision Making

The interactions between social-economic development, urban growth, spatial configuration and the natural environment are complex and therefore difficult to manage effectively. An integrated and evidence based approach is needed to ensure that decision makers can adequately assess the effect of different policy options in a robust and objective way. Such decisions should be driven by the up-to-data and accurate data to be reliable.

Spatial Decision Support Systems (SDSS) including GIS and spatial models can assist policy makers to make informed choices and to better assess the impact of their decisions. There are successful applications worldwide (Thomas and Humenik-Sappington, 2009) underlining the value of geo-spatial tools and models supporting decision makers and planners. GIS is very powerful in integrating, managing and analysing information from raw data, documents, personal knowledge and various models. The proven benefits from numerous applications make a compelling case for using GIS as a strategic tool in decision making (Thomas and Humenik-Sappington, 2009). Some integrated spatial models, such as MOLAND, utilise the considerable power of GIS and includes the capability to simulate future land use change based on social-economic and environmental themes. The MOLAND model was subsequently applied as a tool in regional decision-making contexts (Williams et al, 2009, Brennan et al, 2010) in Ireland. It was extensively used for scenario simulation and comparison, indicator evaluation and analysis (Petrov et al, 2011), urban development probability mapping (Shahumyan et al, 2011), etc. (see Urban Environment Project described in section 2.4).

However, geo-spatial tools and models demand accurate, up-to-date and geographically referenced datasets, which are often not easily available. Even if data is available, it is usually not in the required standards and demand time consuming preparation and standardisation.

In the second part of this report we will describe key social-economic and relevant GIS datasets available for Dublin and Ireland, with a special emphasis on their applicability in advanced geo-spatial analysis. The findings of related studies and research projects are also described.

2. SOCIO-ECONOMIC INFORMATION IN IRELAND

There are several organisations in RoI collecting and analysing socio-economic information. Main relevant data holders in the State and some of the available socio-economic and demographic datasets are listed correspondingly in the Appendices A and B. The provided list is not exhaustive but examines the characteristics of major datasets with an emphasis on gaps and opportunities to enhance them for future applications.

Main general limitations encountered during the study implemented for this report are summarised below:

- Gaps in economic data at a county and local authority level. Many datasets are provided only for the whole country, the Greater Dublin Area or for the main cities.
- Lack of awareness of data that is held across the various agencies and organisations. There are a few initiatives cataloguing different datasets, such as StatCentral[1] and Dublinked[2], but they still do not cover all available data resources in Ireland. Moreover, some of the provided web-links are broken and should be updated.
- Issues in level of spatial coverage and resolution. Most of the socio-economic datasets in Ireland lack accurate geographic information required for advanced spatial analysis. Majority of the databases described below are available in regional or county scale. Barely few are provided in ED scale. And only unique databases such as the GeoDirectory and POWCAR include geographic coordinates, making them very valuable for GIS applications in Ireland. While the GeoGirectory is available from 2003, it is quite expensive and not all organisations can afford it. POWCAR is freely available for researcher, but it is only available for 2006[3].
- Lack of unique identifiers which would allow data integration for combined analysis. Even if the geographic scale used in different datasets are the same, often names of the locations/regions are the only common values. But as a text value they are not effective in linking tables and cause a lot of problem during automatic matching. Sometimes, even the datasets provided by the same organisation are hard to link because of missing common identifier (e.g. CSO SAPS data tables and ED boundary maps: both provided in CSO website, but have no common identifiers).
- Also different organisations provide their data in different file formats. In many cases they are available in tabular format (MS Excel, CSV, SPSS, etc.) allowing easy conversion into relational database. However, some data are publicly available only in reports, newspapers or other publications (PDF, MS Word, etc) and demand a lot of data preparation efforts.

Individual dataset, their general characteristics and specific limitations are described in the Appendix B.

2.1 Datasets

There are several datasets available from various organisations in Ireland providing information on demographic, social-economic, education, business and health situation in the country.

[1] http://www.statcentral.ie

[2] http://www.dublinked.ie

[3] POWCAR from 2011 census will be available later in 2012.

However, little efforts are done to standardise these datasets and link them by attributes and location. Some of the problems are: the lack of unique identifiers for linking datasets as well as the inconsistency of the used geographic names, administrative boundaries, time intervals and spatial resolution. Nevertheless, there have been projects aiming to combine and share data from different organisations. These include:

i) **Dublinked** developed by Dublin City Council, a new regional data sharing initiative sees previously unreleased public and other operational data being made available online for others to research or reuse; and
ii) **All Ireland Research Observatory (AIRO)** interactive spatial data portal developed by NIRSA and acting as an integral resource for the Irish Social Science Platform.

These and a few other relevant projects are described in more details in Section 2.2. While, in this section some key socio-economic datasets are compared with the emphasis on possibility of linking them and using in advanced spatiotemporal analysis.

A major challenge in integrating different datasets is their compatibility affected by geographic and temporal overlaps as well as scales and identifiers match up.

The following datasets were identified for this study and described in the Appendix B in more details:

- Small Area Population Statistics (SAPS)
- Place of Work Sample of Anonymised Records (POWSAR)
- Place of Work Census of Anonymised Records (POWCAR)
- Census of Population Sample of Anonymised Records (COPSAR)
- Live Register (LR)
- Redundancy
- Census of Industrial Production (CIP)
- Annual Services Inquiry (ASI)
- Census of Building and Construction Survey (CBCS)
- Business Demography (BD)
- Household Budget Survey (HBS)
- Quarterly National Household Survey / Labour Force Survey (QNHS / LFS)
- National Travel Survey (NTS)
- EU-Survey on Income and Living Conditions (SILC)
- National Survey of Housing Quality (NSHQ)
- Employees' Attitudes and Expectations of the Workplace Survey (EAEWS)
- Eurostudent Survey (ES)
- CORINE Land Cover (CLC)
- GeoDirectory
- FAME
- Other Business Directories

To identify the possibilities of data integration, these datasets were analysed and their attributes were carefully compared for compatibility. The results are provided below.

In the Appendix B, the datasets are categorized by themes, geographic scales and years covered to make them easy to find, compare and realise their potential. Particularly, the report is focused on the datasets including information from the following *key themes* (in alphabetic order):

- Business
- Demography
- Finance
- Infrastructure

- Economy
- Education
- Employment
- Housing
- Social
- Transport

As for *geographic scale*, the datasets are based on different administrative boundaries such as Provinces, NUTS[1], counties and Electoral Divisions (EDs). The EDs are the smallest administrative areas for which most of the Census data are available in RoI. However, statistical data provided by different organisations are mainly based on county or regional level. Figure 2-1 shows the spatial coverage of these units; while the Table 2-1 and Table 2-2 present their integration and overlap.

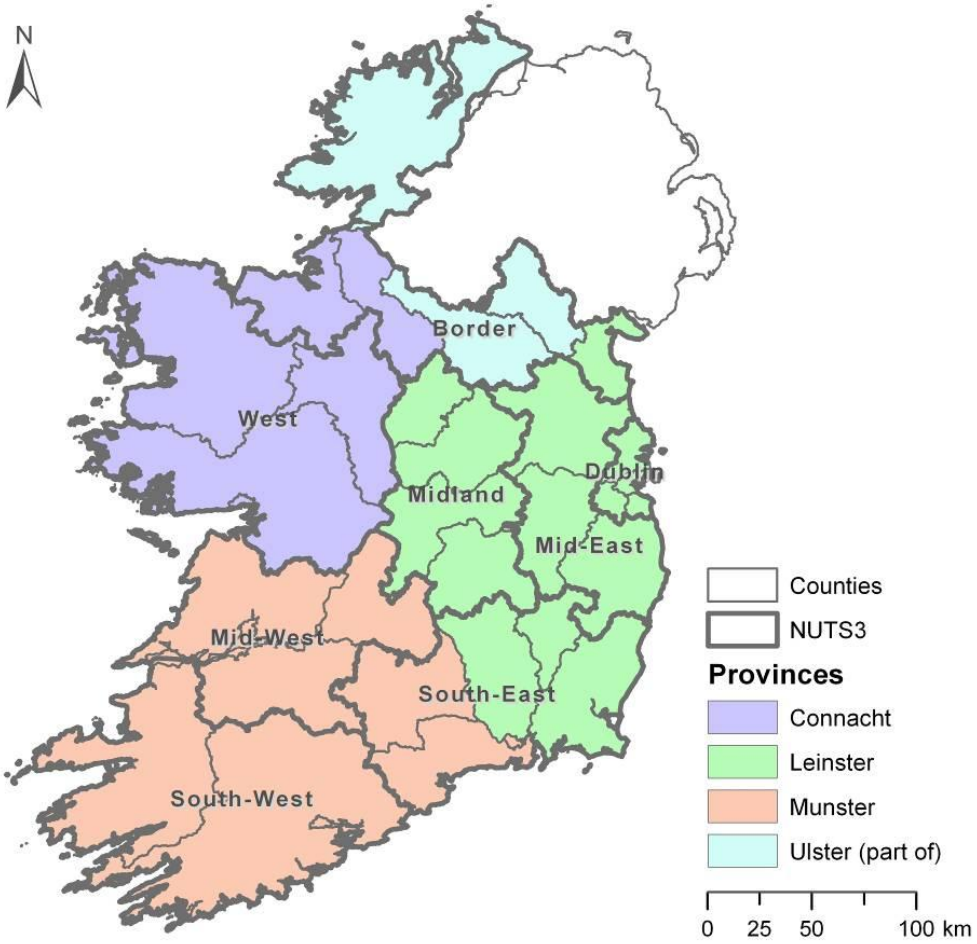

Figure 2-1: Province, NUTS3 and County boundaries in Ireland.

Table 2-1: NUTS of the Republic of Ireland

NUTS 1	Code	NUTS2	Code	NUTS3	Code
Republic of Ireland	IE0	Border, Midland and Western NUTS-II Region	IE01	Border Region	IE011
				Midlands Region	IE012
				West Region	IE013
		Southern and Eastern NUTS-II Region	IE02	Dublin Region	IE021
				Mid-East Region	IE022
				Mid-West Region	IE023
				South-East Region	IE024
				South-West Region	IE025

[1] The Nomenclature of Territorial Units for Statistics (NUTS) is a geocode standard developed and regulated by the EU for referencing the subdivisions of a country for statistical purposes.

Table 2-2: Geographic coverage by different administrative units in Ireland

Province	NUTS3	Local Authority	Area (km^2)	Number of EDs
Ulster (part of)	IE011	Donegal County	4839	151
		Monaghan County	1293	88
		Cavan County	1931	132
Leinster	IE011	Louth County	824	52
	IE012	Laoighis County	1720	138
		Longford County	1092	87
		Offaly County	2001	146
		Westmeath County	1839	151
	IE021	Dublin City	117	192
		South Dublin	224	77
		Fingal	456	74
		Dun Laoghaire-Rathdown	126	82
	IE022	Kildare County	1695	140
		Meath County	2343	149
		Wicklow County	2026	118
	IE024	Carlow County	897	93
		Kilkenny County	2072	167
		Wexford County	2362	144
Munster	IE023	Clare County	3447	190
		Limerick City	21	43
		Limerick County	2735	197
		North Tipperary	2046	138
	IE024	South Tipperary	2259	145
		Waterford City	42	46
		Waterford County	1813	132
	IE025	Cork City	40	83
		Cork County	7444	384
		Kerry County	4793	197
Connacht	IE011	Leitrim County	1588	113
		Sligo County	1834	107
	IE013	Galway City	50	26
		Galway County	6076	270
		Mayo County	5563	185
		Roscommon County	2548	170

The NUTS3 regions correspond to the eight Regional Authorities established under the Local Government Act, 1991 (Regional Authorities) (Establishment) Order, 1993, which came into operation on 1 January 1994. The NUTS2 regions, which were proposed by Government and agreed by Eurostat in 1999, are groupings of the NUTS3 regions. NUTS2 regions originated in Ireland's discussions with the EU on regional development funds. They are not part of either local administrative or statistical framework for economic and social data analysis in Ireland.

The composition of the NUTS regions is as in (Table 2-1). Local authorities and counties share boundaries with NUTS regions and provinces (Figure 2-1); while NUTS2 are consisted of NUTS3 regions, the province and NUTS regions are not aligned. Therefore, the data provided at local authority level can be aggregated to the NUTS2, NUTS3 and province level; the data provided by NUTS3 level can be aggregated to the NUTS2 level. The difficulty with datasets

which are available only at NUTS2 level is that it makes statistical disaggregation at county or city level a major difficulty. Such data can only be aggregated to the State level (Appendix B).

Some datasets (e.g. FAME, Forfas, IDA) include address information, which can be used for geo-referencing the data. However, postal data in the RoI can be a challenge to capture accurately and maintain. Address data is not consistent throughout the country; postcodes are non-existent and are too generalised in the Dublin context to be any use in the geocoding process. Often an address may seem incomplete when it actually contains suitable details for delivery within Ireland. In addition, residents often have a different understanding of their address to their official postal address. There are also issues with the Gaelic and English use of streets and place names. The resident preferred address can include Gaelic variations, locality aliases and townlands, like the following example[1]:

Geodirectory Address	**Resident Preferred Address**
Carob Cottage,	Carob Cottage,
Derryhansa,	Montpelier,
O'Briensbridge,	O'Briensbridge,
Limerick	Limerick

Common spelling errors can create difficulties as well. Therefore, using address information for data joining is not a straightforward task and may demand significant manual work or special geocoding software. Particularly, address matching software can utilise fuzzy logic to correct and match this type of data. There are companies specialised in address validation and matching in Ireland, like Gamma Ltd and Experian QAS.

2.2 Data Compatibility

For the purpose of this report we have studied most comprehensive and known socio-economic datasets covering the Republic of Ireland for the period of 1990-2011. The datasets were analysed from the perspective of their applicability to economic development policy and quality for spatiotemporal analysis, regional modelling and GIS applications.

The datasets covered were considered in terms of the timeframe, their geographic availability and theme types important for economic development policy making.

Key issues with relation to the data included

- Timeframe of the dataset (once off, continuous, periodic, etc.)
- Consistency with definitions / classifications (economic classifications, etc.)
- Level of geographic availability (point, ED, county, region, etc.)

As shown in the Table 2-3, a lot of information on many of studied theme categories is available from several datasets. However, mostly, these datasets are available for different geographic scale (Table 2-4) and different timeframe (Table 2-5).

The comparison of geographic scales showed that most of the data are available for county/LA or NUTS3 level (Table 2-4). However, for proper GIS applications at least ED level data is required. Therefore the datasets such as SAPS, POWCAR, GeoDirectory and CLC are very valuable and have substantial potential for spatial analysis. While other important datasets, such as QNHS, HBS, SILC and FAME, may be very useful in national or regional studies but not for detailed geo-spatial analysis.

[1] Source: Experian QAS (http://www.qas.ie)

Table 2-3: Datasets theme category overlap

	Business	Demography	Economy	Education	Employment	Finance	Infrastructure	Housing	Social	Transport
SAPS		■	■	■	■			■	■	■
POWSAR		■	■	■	■			■	■	■
POWCAR		■	■	■	■			■	■	■
COPSARs		■	■	■	■				■	
LR		■			■				■	
Redundancy					■					
CIP	■		■		■	■				
ASI	■		■		■	■				
CBCS	■		■		■	■				
BD	■				■					
HBS		■	■	■	■	■		■	■	■
QNHS/LFS		■		■	■			■	■	
NTS		■	■	■	■			■		■
SILC		■	■	■	■	■		■	■	
NSHQ		■				■		■		
Eurostudent		■	■	■	■	■		■	■	■
GeoDirectory	■						■	■		
FAME	■		■		■	■				
CLC							■	■		

Table 2-4: Datasets spatial scale overlap

	Coords	Address	Towns	ED	County	NUTS3	NUTS2	Province	State
SAPS			■	■	■	■	■	■	■
POWSAR			■	■	■	■	■	■	■
POWCAR	■		■	■	■	■	■	■	■
COPSARs					■	■	■	■	■
LR						■	■	■	■
Redundancy					■	■	■	■	■
CIP					■	■	■	■	■
ASI							■	■	■
CBCS									■
BD					■	■	■	■	■
HBS						■			
QNHS/LFS						■			■
NTS						■			■
SILC						■			■
NSHQ					■	■	■	■	■
Eurostudent					■	■	■	■	■
GeoDirectory	■	■	■	■	■	■	■	■	■
FAME		■							
CLC	■		■	■	■	■	■	■	■

Nevertheless, most of the datasets, including the ED level data mentioned above, are available only for some years in the last 2 decades (Table 2-5). Moreover, these years are usually not overlapping for different datasets, making combined spatio/temporal analysis hard to implement. Thus the SAPS data is available for census years (1991, 1996, 2002 and 2006), while POWCAR was implemented in 2006[1], CLC is available for 1990, 2000 and 2006, and the GeoDirectory is available only from 2005. 2006 is the year when the most overlap between considered datasets happens, followed by 2005 and 2002.

Table 2-5: Datasets temporal overlap

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
SAPS		■					■						■				■					
POWSAR													■									
POWCAR																	■					
COPSARs							■						■				■					
LR	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Redundancy	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CIP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ASI										■	■	■	■	■	■	■	■	■	■	■	■	■
CBCS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BD																	■	■	■	■		
HBS					■					■	■				■	■						
QNHS/LFS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
NTS																				■		
SILC														■	■	■	■	■	■	■		
NSHQ												■	■									
Eurostudent																				■		
GeoDirectory														■	■	■	■	■	■	■	■	■
FAME																						■
CLC	■										■						■					

A number of datasets also use industry, building type or occupation classification (see Appendices). Although there are some similarities (Table 2-6), there is no standard classification used in the surveys, making comparison analysis hard to implement. Even datasets from the same agency use different naming or grouping for different years (e.g. CSO datasets in Table 2-6). Sometimes the grouping is obvious and the datasets can be compared using wider groups. For example in POWCAR and POWSAR the industrial category "Manufacturing industries, mining, quarrying and turf production, electricity, gas and water supply" is just a grouping of three separate categories used in SAPS datasets: (i) Manufacturing industries, (ii) Mining, Quarrying and turf production and (iii) Electricity, gas and water supply. However, much often the grouping is not such obvious, like in case of the commercial industries. It is provided as "Commerce, insurance, finance and business services" in 1991 and 1996 SAPS, then as "Commerce and trade" in 2002 and 2006 SAPS, and just "Commerce" in POWCAR and POWSAR (Table 2-6). Such cases demand detailed study of the methodology applied for different datasets and often application of much wider grouping can be the only solution for data comparison analysis.

[1] Though a comparable study (POWSAR) was implemented in 2002, however it was done for 15% representative sample only, while POWCAR was part of the Census. Data from Census 2011 will be available in mid-2012.

Table 2-6: Industry classification used in different datasets

	SAPS 1991, 1996	SAPS 2002, 2006	Census Other[1] 2002, 2006	POWSAR2002 POWCAR2006 COPSAR 1996, 2002, 2006	CIP	ASI	CBCS	BD	QNHS 1998-2010 EAEWS 2009	SILC 2003-2009 NTS 2009	Geo-Directory	FAME
NACE codes					■						■	■
Accommodation and Food Service Activities						■		■			■	
Administrative and Support Service Activities						■		■			■	
Agriculture, forestry and fishing	■	■	■	■					■	■	■	
Agriculture, mining, etc. (Primary Sector)												■
Arts, entertainment and recreation						■					■	
Banks												■
Banking and financial services			■									
Building and construction	■	■	■	■					■	■		
Chemicals, rubber, plastics, non-metallic products												■
Commerce				■								
Commerce and trade		■										
Commerce, insurance, finance & business services	■											
Construction							■	■			■	■
Education			■						■	■	■	
Education, health and social work				■								
Education, Health												■
Electricity, gas and water supply	■		■							■		■
Electricity, Gas, Steam and Air Conditioning								■			■	
Financial and other business services									■			
Financial and Insurance Activities						■		■			■	
Financial intermediation										■		
Food, beverages, tobacco												■
Health									■	■		
Health and social work			■							■	■	
Hotels and restaurants			■						■	■		■
Information and Communication						■		■			■	
Insurance companies												■
Machinery, equipment, furniture, recycling												■
Manufacturing industries	■	■	■					■		■	■	
Manufacturing industries, mining, quarrying &				■								

[1] Census Volume "Principal Economic Status and Industries" (Table 12 at http://census.cso.ie/census)

	SAPS 1991, 1996	SAPS 2002, 2006	Census Other[1] 2002, 2006	POWSAR2002 POWCAR2006 COPSAR 1996, 2002, 2006	CIP	ASI	CBCS	BD	QNHS 1998-2010 EAEWS 2009	SILC 2003-2009 NTS 2009	Geo-Directory	FAME
turf production, elect., gas and water supply				■								
Metals & metal products												■
Mining, quarrying and turf production	■		■							■		
Mining and Quarrying								■			■	
Post and telecommunications												■
Professional services	■	■										
Professional, Scientific and Technical Activities						■		■			■	
Public administration and defence	■	■	■	■					■	■	■	■
Publishing, printing												■
Real estate, renting and business activities			■							■		
Real Estate Activities						■		■			■	
Transport, communication and storage	■	■	■	■					■	■		
Transportation and Storage						■		■			■	
Transport												■
Water Supply; Sewerage, Waste management and Remediation Activities								■			■	
Wholesale and retail trade			■						■	■		■
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles			■			■		■			■	
Wood, cork, paper												■
Other community, social & personal service			■									
Other production industries									■			
Other services						■			■		■	■
Other industries or industry not stated	■	■	■	■						■		

2.3 Long Term and On-going Initiatives

There are a number of on-going projects aiming to distribute some of the described datasets for researchers and wider public. Some of them are presented below.

Cities and Global Benchmarking

Website: http://www.creativedublinalliance.ie

One means to determine global Dublin's socio-economic and environmental position is to examine global metrics of performance. While these metrics are often based on subjective perception as much as hard statistical evidence, they provide well respected opinion on the performance of cities across a range of sectors and are arguably very influential in corporate decision-making. Moreover, they allow cities to compare themselves against best practice (especially in competitor cities of comparable economic and population size) and to plan strategies accordingly. In time they will provide feedback on how effective these strategies are.

A number of key benchmarking datasets therefore are being identified and examined. These datasets refer to the position of the Dublin city region or Ireland in the context of specially selected groups of cities, OECD countries, EU cities and regions or global groupings. Where data at city region are not available national benchmarks will be used in their place.

While Dublin is a relatively small metropolitan city region in international terms, it features regularly in international indices and represents Ireland's only city of relevant global scale. As the world becomes ever more urbanised and cities become increasing focal points for national, macro-regional and international activity metrics to measure the comparative performance of these economic hubs/markets will inevitably increase in importance. One need only consider that city regions are responsible for generating more than 80% of global GDP (McKinsey, 2011) yet they occupy just 2% of the world's land surface to begin to understand the level of importance of these economic and population hubs.[1] In Ireland, the population of the Dublin City Region represents just under 30% of the national population and approximately 40% of economic output. Since 2008, for the first time in human history over half the world's population live in cities[2]. Furthermore, by 2030 it is estimated that the proportion of citizens globally living in city regions will have risen to over 60% and to 70% by 2050[3].

This urbanisation is driven by a number of factors which varies according to geographic location, economic status and a range of other factors. One central factor is the recognition of cities as crucibles of innovation, of higher levels of labour productivity and GDP per capita. As firms and mobile skilled workers become more selective about their choice of location it is therefore crucial that metrics to measure the global performance of Dublin are developed.

Appendix I presents broad level categories which have been identified for further analysis within this study. They will allow the Dublin City Region to identify, within an international context, its strengths and weaknesses and thus opportunities for improvement. For each category issues of data comparability (for example, geographical scale) and data reliability (for example, perception versus performance) will be carefully considered. Benchmarks of course cover a variety of topics including macro-economics, the digital agenda, quality of living, sustainable development, knowledge activity, financial services, connectivity and globalisation, innovation and creativity, societal functioning just to name a few. Many of these are interconnected.

[1] http://www.un.org/News/briefings/docs/2010/100325_DESA.doc.htm

[2] United Nations, http://www.unfpa.org/pds/urbanization.htm

[3] "Dublin Open"- Open Cities Local Action Plan, Dublin City Council, 2011

Dublinked

Website: http://www.dublinked.ie

Dublinked is a new open data initiative that invites business, technologist, application developers, entrepreneurs and researchers to join a unique data sharing network that utilises public sector data to address city challenges and test new applications, products and services in the city region. With the initial data coming from Dublin City Council and Dun Laoghaire Rathdown, South Dublin and Fingal County Councils, it is expected that other public and private organisations in Dublin will link up with Dublinked to share their data and invite research collaborations.

The information is curated by National University of Ireland (NUI) Maynooth to ensure ideas can be commercialised as easily as possible and to minimise legal or technical barriers that can be impediments for small and medium businesses seeking to develop and prove business ideas. The initial release of data consists of over 100 environmental, traffic and planning datasets including:

- Planning application data from across the region
- Water flow, rainfall and energy monitoring
- Air, water pollution and noise maps for the Dublin region
- A wide array of usable mapping from development plans, river catchment and drainage
- Parking, residential and disabled parking as well as detailed traffic volumes

StatCentral

Website: http://www.statcentral.ie

StatCentral is the portal to Ireland's Official Statistics. It provides information about statistics produced by government departments and state organisations. Most of these statistics are available on the web through a variety of websites and formats; and the StatCentral links to where they can be found.

StatCentral is maintained by the CSO and aims to strengthen and coordinate statistics across the public service. The portal supports the National Statistics Board's strategy[1] of developing a whole-system approach for the Irish statistical system, involving all areas of the public sector where official statistics are produced. StatCentral has been launched with a range of official statistics from the CSO and other departments and agencies. The list of covered statistics is regularly updating, with the ultimate aim of covering all official statistics.

All Island Research Observatory (AIRO)

Website: http://www.airo.ie

AIRO was initially established as a pilot project under INTERREG 111A with the guidance and lead of the National Institute for Regional and Spatial Analysis (NIRSA) and the National Centre for Geo-Computation (NCG) based in the NUI Maynooth. Other partners include Queens University, Belfast and Dundalk Institute of Technology.

The aim of the project was to provide reliable cross border information through the collection, analysis and mapping of data relevant to the region. It is intended to provide a spatial, social and economic databank resource for community, public and private bodies. Following a pilot

[1] http://www.nsb.ie/pub_documents.htm

project and subsequent minor development extensions, AIRO secured funding under the HEA Programme for Research in Third Level Institutions (PRTLI4) for the period 2008 to 2011.

Currently, AIRO seeks to produce all-island, spatial datasets and specialist tools to aid their analysis and to undertake academic and applied mapping research. AIRO aims to be a single point of access for a wide variety of spatial data and information about the various regions of Ireland. The intended audience of this site are planners, policy makers, researchers and those interested in the dynamics that are shaping the island of Ireland today.

A series of information is available on 14 main themes:

- Agriculture
- Arts
- Culture and Leisure
- Communications and Technology
- Community and Social Demographics
- Economy
- Education
- Environment and Energy
- Health
- Housing
- Industry, Employment and Labour Market
- Regional and Local Development
- Tourism
- Transport

The information in these themes is separated in four sub-sections: mapped outputs, organisations, publications and statistics.

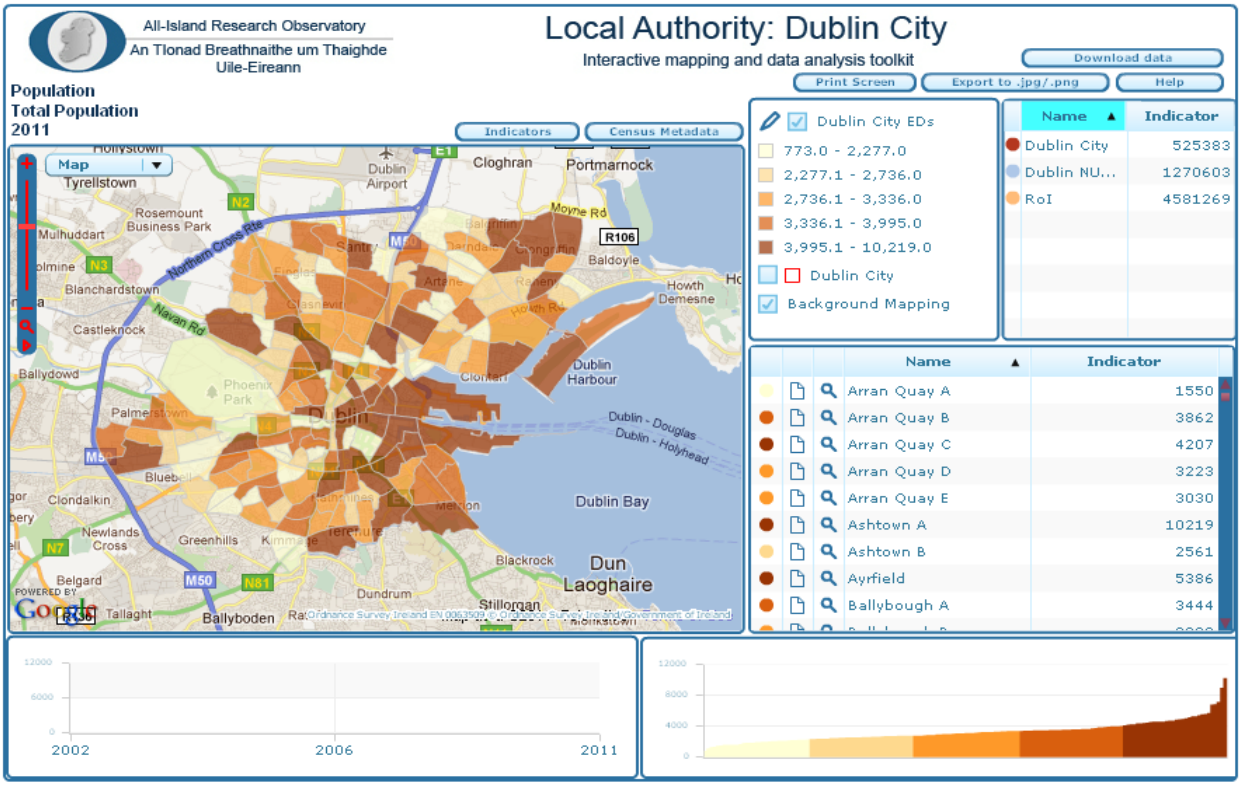

Figure 2-2: AIRO Mapping Module showing 2011 population in Dublin City by ED.

The AIRO also contains useful interactive tools such as:

- An indicator section which provides access to data in an interactive and accessible manner, allowing viewing, selecting and filtering downloadable data.
- Mapping modules presenting dynamics of local areas, counties, regions and cross-border areas in Ireland (Figure 2-2). The AIRO team is actively seeking spatial datasets that can be loaded into this system.

- A geographical profiling tool that allows registered user's to create a user defined request for statistical information for their area of interest. A wide variety of data is available from 2002/2006 censuses and 1991/2001/2002 comparable cross border datasets.
- All-Island Deprivation Index tool was launched recently showing the spatial distribution of deprivation on an All-Island basis. A key aim of this new mapping tool is to make evidence of social deprivation and the distribution of services more accessible, and to support evidence-based decisions in terms of planning and development.

The All-Island Accessibility Mapping Tool provides an analysis of access to settlements and key service infrastructure such as transport, education and health facilities across Ireland. Accessibility scores to a range of services have been developed for every residential address point on the island (approximately 2.7m) based on average drive-time speeds.For policy makers, local authorities, businesses and communities seeking to make urban and rural environments desirable places to live and work, access to such tools are critical to planning, funding, implementing and monitoring new schemes and initiatives.

As AIRO develops it is hoped that each user will be able to select key public facility data to be included within a request.

DecisionMap

Website: http://www.decisionmap.ie

DecisionMap is designed for decision makers; specifically for those in both the public and private sectors who make decisions based on complex statistical information about Ireland. It has been created by OSI and Twelve Horses with the goal of encouraging enhanced use of publically available data to aid decision making in the public and private sector.

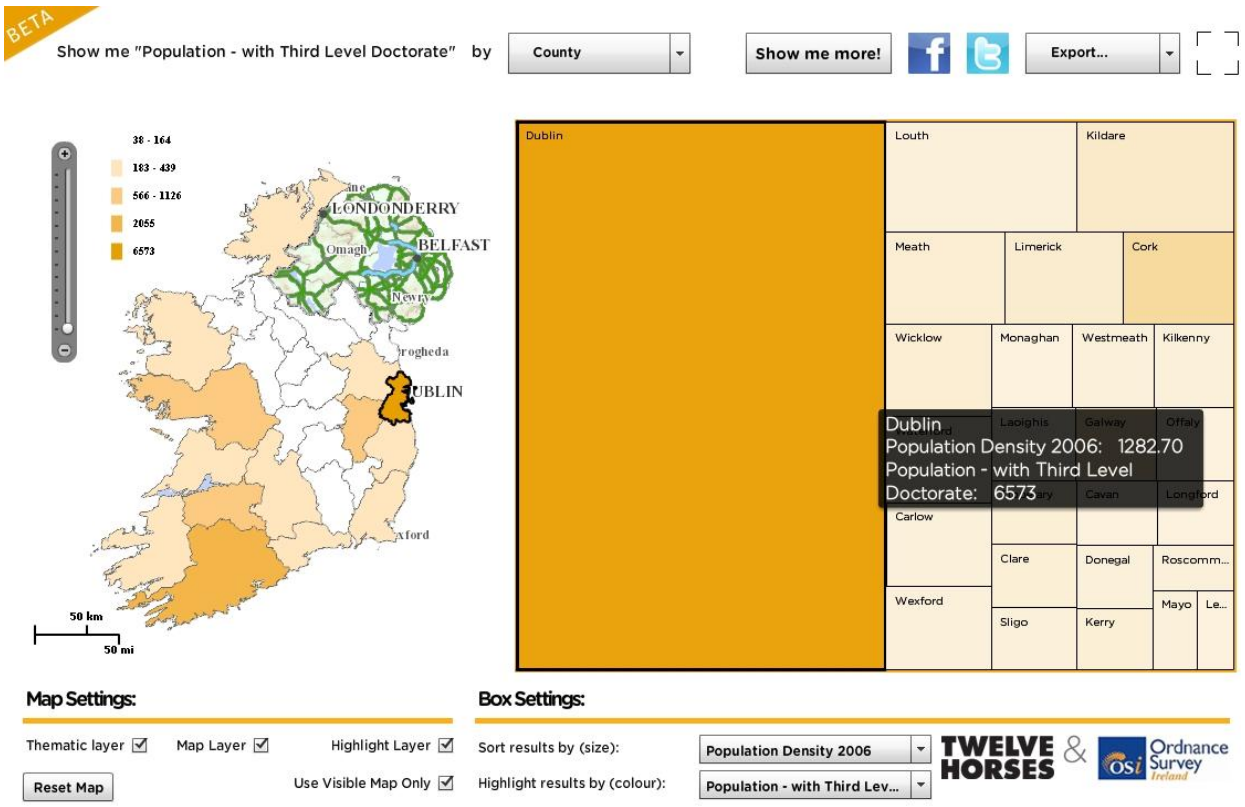

Figure 2-3: DecisionMap interface showing population doctorate by county in 2006.

The maps and visualisations use multiple sources including data collated by the CSO provided through the NUI Maynooth. DecisionMap brings these services together. Currently it is in Beta version and uses data from the 2002 and 2006 Census. It is intended to develop DecisionMap more over the coming months; and to add 2011 Census data as soon it is released.

DecisionMap allows to view complex statistic data using two different techniques: (i) a mapping interface (left side of the Figure 2-3), and (ii) data tiles (right side of the Figure 2-3).

Health Atlas Ireland

Website: http://www.hse.ie/eng/services/maps

Health Atlas Ireland is a joint Health Service Executive (HSE) and academic initiative. The project is supported by a number of Irish Public Organizations: the Health Information Unit, Health Intelligence, Population Health, Health Protection Surveillance Centre, UCD, NUIM and DCU. Excellent collaboration both within and outside the HSE including OSI, CSO, AnPost / GeoDirectory, the Universities, ESRI, National Cancer Registry, Road Safety Authority, National Roads Authority, and An Garda Síochána, assist the project.

In the absence of an off-the-shelf solution, a new system was designed and developed. It enables customers to view, on a map, detailed location and contact information on health services provided in communities across Ireland including Pharmacies, Dentists, GPs, Hospitals, Health Centres and Nursing Homes (Figure 2-4).

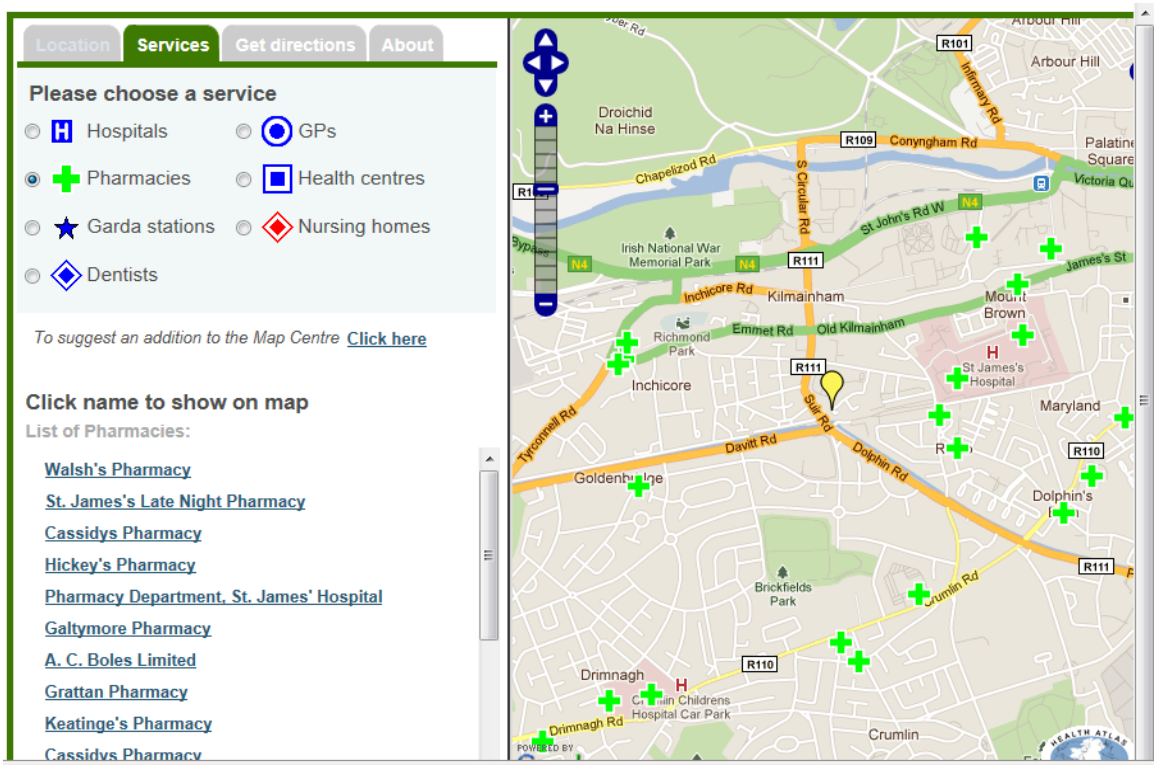

Figure 2-4: HSE Health Atlas website

All applications developed within Health Atlas are web-based and directly accessible through a browser. Any user can access the Health Atlas applications with a login and password.

It is easy to show on tables or maps as numbers, colours or symbolization demographic patterns; hospital activity; service locations and catchments areas; and health patterns. GeoDirectory is embedded so addresses can be pin pointed on a map. Drug prescribing, financial and human resources, disease registers, source allocation, quality of care, travel times/distances, and environmental data will be added together with a public view.

Following a nomination for the Health Service Executive “2007 achievement awards”, Health Atlas won the Irish Public Service Excellence Award 2008. The project was selected among dozens projects for its innovation capacity and its technical perfection. It is an innovative project that improves the quality and the efficiency of services delivered by health services.

Regional Environmental Accounts in Ireland

Environmental accounts are prepared by the ESRI to provide information on emissions and resource use. Environmental accounts are so-called satellite accounts to the national accounts, which provide a comprehensive framework to present economic data in a coherent, consistent, and internationally comparable manner. Environmental accounts are specifically designed to reveal the pressure the economy puts on the environment, and are therefore an essential input to policy analysis and design (Lyons et al, 2008).

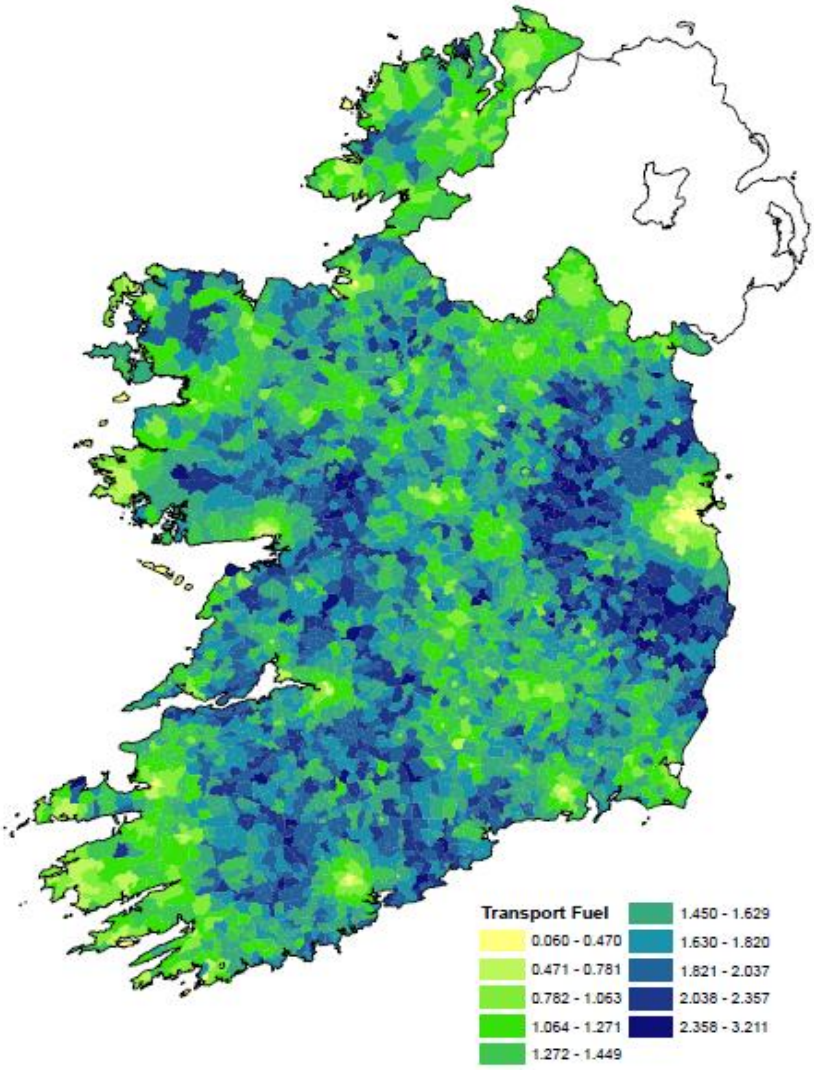

Figure 2-5: Average daily consumption of transport fuels per person in 2006 (Tol et al, 2009)

Existing environmental accounts for the RoI are at the national level. This is adequate for continental and global environmental problems, but information at a finer spatial scale is needed for local environmental problems. Furthermore, the impact of environmental policy may differ across space. ESRI researchers therefore constructed regional estimates of the environmental pressures posed by Irish households and the environmental problems faced by them (Tol et al, 2009). The basic unit of analysis is the ED, and the prime data source is the CSO‘s Small Area Statistics, a product of the Census.

The results showed marked regional differences. Electricity use and waste arising are higher in the East and in the cities and towns. Transport fuel use is highest in the commuter belts around the cities and towns (Figure 2-5). Other energy is relatively uniform. There is no clear pattern in estimated drinking water use, which may be due to data quality. Drinking water quality is poor across much of the country, but different counties suffer from different problems. The regional estimates are constructed using data in the public domain. However, various Government Departments and State Agencies hold data that would allow for the construction of more detailed, more accurate, and more extensive regional environmental accounts (Tol et al, 2009).

The limited scope of the accounts notwithstanding, the results reveal that the spatial pattern of the impacts of energy and climate policy is different than many thought it is. There is a distinction between rural and urban areas, but there is a much sharper distinction between the commuter belt and other areas of the countryside (Tol et al, 2009).

Conclusions call for better data, and there is ample room for improvement. In sum, regional environmental accounts can be constructed for Ireland. This research showed that the emerging insights are well worth the effort (Tol et al, 2009).

EPA SAFER data repository[1] holds more data on the environment in Ireland.

NTA Transport Model

The NTA transport model is a strategic multi-modal, network based transport model covering the GDA (NTA, 2011b). It was developed in 1991 as part of the Dublin Transportation Initiative study. The Dublin Transportation Office (DTO) was established in 1996, took ownership of the model, and was given the remit to maintain and regularly update the model and make it accessible to DTO agencies and third parties on request (DTO, 2008). The latest update of the DTO's transport model was completed in late 2009. Following this, the DTO was subsumed into the National Transport Authority (NTA) that was established in December 2009. The DTO transport model is now owned by the NTA, who are the authority responsible for its maintenance and use.

The model includes all the main surface modes of travel such as car, bus, rail, heavy goods vehicles, walking and cycling. It comprises a morning peak model covering the three hour period between 07:00 and 10:00 and an afternoon inter-peak model covering the single hour between 14:00 and 15:00 (NTA, 2011b). The main drivers of travel demand are urban development and economic growth. In calculating trip generation rates for each of 666 zones in the GDA, trips are classified by the following home-based trip proposes: Work (commuting), Education, Shopping, Other (social, leisure, personal business, etc), and Employer's Business (i.e. business trips in the course of work). Trips rates are also calculated for non-home-based (or intermediate) trips.

Analysis of historic car ownership trends in the GDA shows that levels of ownership vary significantly depending on (NTA, 2011b):

- Location (people living within the City Centre and large Town Centres have in general much lower levels of car ownership than people living in rural parts of the GDA).
- Socio Economic Group (Managers and Higher professional workers in general have higher levels of car ownership than semi-skilled or unskilled workers).

Hence, in order to track and forecast car ownership levels, the model divides the GDA into 15 different area types based on 5 geographical area bands (Figure 2-6) and 3 socio-economic groupings within each area band. The socio-economic groupings used in defining area types

[1] http://erc.epa.ie/safer

are based on the percentage of Employers, Managers and Higher Professionals among the working population in each modelled zone.

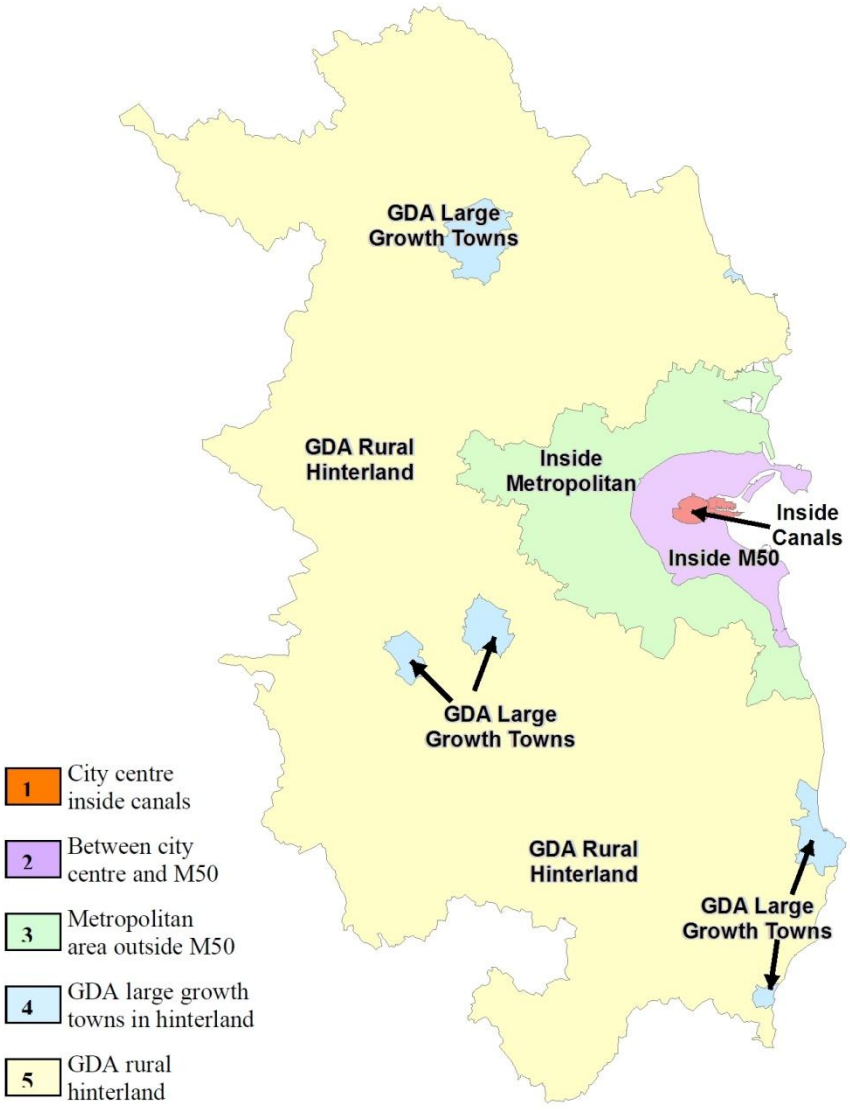

Figure 2-6: The GDA geographic area bands used in DTO Transport Model (NTA, 2011b)

The model uses a number of important datasets such as SAPS and POWCAR from 2006 census described above; as well as Travel to Education Survey and Household Survey implemented by DTO in 2006 (DTO 2007, 2006).

The NTA also consults with all local authorities within the region to ascertain where development will take place. Additionally, the analysis process needs to account for the infrastructure that will be provided to cater for the travel demand generated by these developments.

The principal outputs for the model are:

- Traffic flows on all major roads in the GDA.
- Junction delays and queues
- Journey times on all major routes into the city
- Passenger flows on all Bus and Rail routes in Dublin
- Summary statistics in the form of indices for the region

A major strength of the model is its ability to test transportation and land use scenarios and carry out "what if" type analysis. It has been used to help predict, for example, the traffic impacts

of introducing Luas, building the Dublin Port Tunnel and completing the C-Ring motorway. Hence, the model has been used as the principal design and evaluation tool for these and the entire major roads and public transport proposal currently being planned and implemented in Dublin.

Currently the model used by the NTA and its agencies to assess the impacts of major land use and transportation developments proposed for the GDA over the next few years. The model was recently used in the development of Transport 21[1] to assess the transportation infrastructural needs of the region over the next 10 years.

Though the model utilises land uses data, there is no dynamic land use model linked to it. Therefore, the output from the model MOLAND can be a valuable input for the NTA transport model, especially for future scenarios simulations.

Gateway Development Index

Website: http://www.irishspatialstrategy.ie/Publications/11497BMWGDIReport.pdf

The main objective of the NSS (2002) is to achieve more balanced and sustainable regional development in Ireland by delivering a better quality of life for everyone, which includes the delivery of vibrant urban and rural areas and an improved environment. Under the NSS, Gateway cities and towns are identified as key catalysts to stimulate regional growth in different regions, whereas strategically placed hubs are charged with driving development in their catchment areas while also supporting the activities of gateway cities (see Figure 1-1). The Gateway Development Index (Fitzpatrick Associates, 2009) evaluates the impact of investment in the gateway cities under the National Development Plan (NDP) and the Regional Operational Programmes (ROPs) for the period 2007-2013.

A priority objective of the two ROPs is to focus investment in the designated Gateways and Hubs in order to strengthen their attractiveness, accessibility and competitiveness. This is consistent with the EU Community Strategic Guidelines 2007-13 which emphasise the contribution of urban growth centres to competitiveness and employment and recommend that integrated economic, social and environmental initiatives should be supported under the European Regional Development Fund co-financed programmes. A fundamental requirement for all co-financed programmes is that the results and impacts of the activities are amenable to monitoring and evaluation.

The project was managed by a Steering Committee comprised of representativeness the two Regional Assemblies and the Spatial Policy Unit of the Department of Environment, Heritage and Local Government. The index was constructed by a consultancy team led by Fitzpatrick Associates. The domains and indicators used were identified at national and regional workshops held during 2008. The Gateway Development Index will be reproduced in 2010 and 2013. The compilation of the index study was co-funded by the European Regional Development Fund.

[1] http://www.transport21.ie

2.4 Selected Examples of Relevant Studies

The datasets described above and in the Appendix B were extensively used by many researchers. A few selected examples are presented in this section with particular focus on the studies with geo-spatial applications.

Urban Environment Project (UEP)

Website: http://www.uep.ie

The UEP was sponsored by the EPA as part of the ERTDI programme which is funded through the National Development Plan. It has explored urban environment impacts in the GDR in an integrated manner recognising the interplay of environmental factors but underpinned by discrete analyses on a thematic basis, to inform both environmental policy relating to urban areas as well as strategic spatial planning policy.

In supporting the formulation and implementation of environmental policy, the key challenge was to understand the linkage between development and environmental performance. As environmental impacts often depend also on location, where the development and associated impacts take place is also an important consideration. This project has developed the analytical capacity to link development-space-environment dimensions of this important policy debate.

Under the aegis of the European Commission Joint Research Centre (JRC), the MOLAND[1] urban land use model was developed by Research Institute for Knowledge Systems (RIKS)[2]. For a given area the MOLAND generates predictions as to future land uses under various economic and demographic scenarios (Engelen et al, 2007). In scope of the UEP this has been adapted and calibrated for the Greater Dublin Region using 1990, 2000 and 2006 datasets. Each of the relevant sub-projects in UEP - air quality, biodiversity, climate change, transport and urban sprawl - was structured to both provide data for the MOLAND model, and also to answer theme-specific questions. This ensured consistent integration of the various strands of the research.

The MOLAND model supports ‘scenarios’ approach providing a tool for reaching a better understanding of the possible outcomes of different policy options as well as providing a means of exploring the effects of the ‘business as usual’ scenario. It also enables qualitative storylines to be converted into quantitative scenarios, the effects of which can be measured, repeated, compared and analysed (Petrov et al, 2011).

In collaboration with the Dublin and Mid-East Regional Authorities (D&MERAs) the MOLAND model was used to generate scenarios illustrating the effects of future policy directions on the GDR (D&MERA, 2010). Following extensive consultations with D&MERAs and stakeholders four scenarios were constructed for evaluation as part of the Strategic Environmental Assessment (SEA) process in reviewing the GDA Regional Planning Guidelines (RPG):

1. Baseline/Continued Trends Scenario (SEA1): exploring the consequences of continuing the current settlement patterns, whereby actual settlement patterns are somewhat at odds with RPG policy (Convery et al, 2006).
2. Finger Expansion of Metropolitan Footprint Scenario (SEA2): development is focused within the Metropolitan Footprint (MF) of Dublin city, with minimal growth in other areas and expansion of the MF along key transport corridors.

[1] Monitoring Land Use Dynamics (http://moland.jrc.ec.europa.eu)

[2] http://www.riks.nl

3. Consolidation of Key Towns & the City Scenario (SEA3): explores a settlement pattern similar to that proposed in the original Strategic Planning Guidelines published in 1999 (D&MERA, 1999). This settlement pattern requires development to be consolidated within the existing MF and a small number of development centres along major transport routes. The MF does not expand along these routes.
4. Managed Dispersal Scenario (SEA4): dispersal of development is managed by focusing growth within the existing MF and several development centres across the region. Strictly enforced strategic green belts are used to prevent the merger of towns and ensure corridors remained between urban and rural natural areas.

These scenarios were then evaluated in terms of several indicators of sustainability and the results discussed in terms of the implications these future settlement patterns on the environment of the region (Brennan et al, 2009). Comparison of the residential areas of the simulated maps in 2026 with the existing residential areas in 2006 shows that the GDR may have substantially different development patterns depending on the decisions made now (Figure 2-7). Thus, in the business as usual scenario (SEA1), a dispersed settlement pattern and merger of formerly separate urban areas are observed. In case of SEA2 scenario the development is extensive to the West of Dublin city and coastal areas. In SEA3 scenario development to the West of the city is less intense than in SEA2 scenario, with this development focused into the growth centres of Drogheda, Navan, Naas, Wicklow and Arklow. Finally in case of SEA4 scenario, while development is dispersed across the region, it is consolidated into several growth centres of Arklow, Balbriggan, Drogheda, Navan, Naas, Newbridge and Wicklow. This contrasts with the business as usual scenario (SEA1) where development is widely dispersed in small pockets across the region.

In collaboration with D&MERA the MOLAND model was also used to examine spatial distribution of three different population projections and how this will impact on planned future Waste Water Treatment Plant (WWTP) capacity and defined catchment areas in the GDR (Williams, et al 2010).

In order to compare scenarios, sample indicators were developed which provide quantitative measures of the key environmental impacts related to the land use changes which are simulated under the different scenarios. Some of the indictors are spatially explicit and can be used to assess the spatial aspects of alternative spatial planning strategies and environmental policies. These applications show the practical use of the model MOLAND and GIS in 'real-world' policy settings.

UEP research findings indicate that managed increased density land-use is inherently more energy-efficient and if combined with improvements in public transport result in lower per capita emissions. Well-designed mixed-use developments can reduce transport-related emissions by reducing travel to employment and services and could enable an increased modal shift to public transport. For example, hinterland areas show up to 15 times higher transport related energy consumption[1]. When compared with a business as usual scenario a compact city scenario represents a saving of 18% in transport related energy consumption. In addition a compact urban form could provide a 16% decrease in energy demand for space heating under the climate change scenario tested.

[1] Transport related Energy Consumption is a composite made up of journey length, time, mode and occupancy for the commute to work.

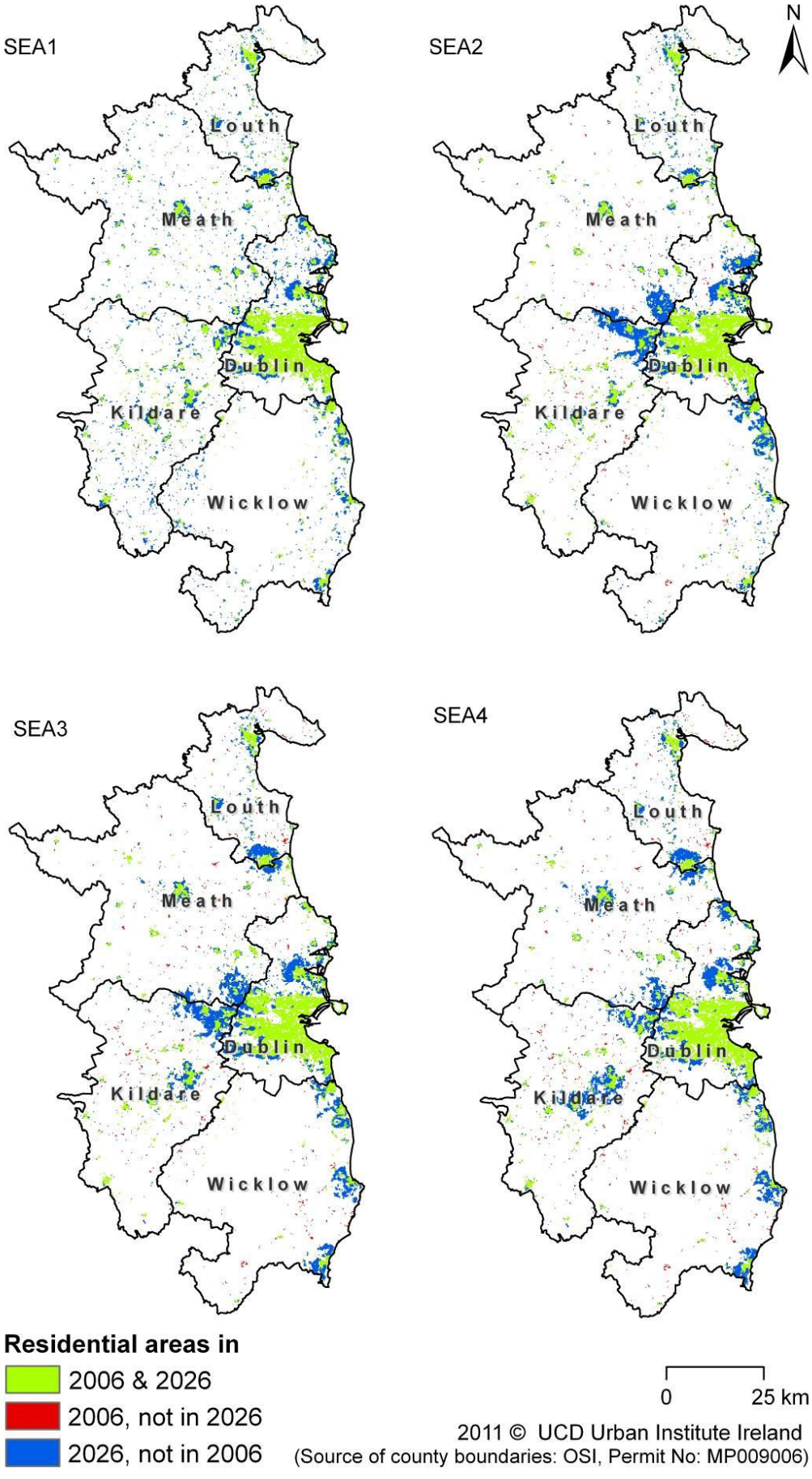

Figure 2-7: Residential development patterns in GDR from 2006 to 2026 under four different scenarios simulated for Strategic Environmental Assessment

The spatial distribution of development can have a significant impact on biodiversity assets in the region and spatial planning strategies need to take this into account. For example; in the period 1990 – 2006, although the overall percentage of green space to built fabric remained constant over time, the losses and gains of green space were not evenly distributed throughout the city. Green space was mainly lost near the Dublin city centre to infill development, where it converted to built areas whilst the green space gained was at the perimeter of the city reducing the area of agricultural land and semi-natural vegetation types. This resulted in a net loss of vegetated surfaces both within and outside the city.

The spatial distribution of population has increased considerably without a parallel increase in public transport infrastructure resulting in a significant reliance on the car. Another research in scope of UEP developed a methodology for an activity-based description of the emissions of pollutant species from either a single vehicle or a specific category of vehicles. This allows for the calculation of a daily distribution of speed, based on real traffic flows rather than an average vehicle speed estimation based on the national average. Thus more accurate calculations of the impacts of vehicle usage on air quality at a local scale can be made.

Works by Williams et al (2009) and Brennan et al (2009) demonstrate how MOLAND could be used to support specific integrated decision-making processes. However, in working with MOLAND a number of significant data gaps have been identified including a lack of harmonised data (both scalar, temporal and contextual) relating to zoning status of lands in the region. This highlights a need to better co-ordinate between and across local authorities, regional authorities and other relevant agencies working in the GDR.

Drawing on research carried out by the project team a digital atlas was published providing a gateway to the work of the project which draws on the insights and expertise of a wide range of scientific disciplines including ecology, civil and mechanical engineering, climatology, human and physical geography and spatial planning. It illustrates key geographical aspects of urban environmental change in the Dublin city-region over the period 1990-2006 as well as for the future scenarios of 2026. The atlas and other publications are available at the UEP website.

Demographic Trends in Dublin

This study forms part of the “Think Dublin!” Research Series that encourages an evidence-based approach to developing policy in the city while also highlighting the key role of Dublin in the national and international context. It examines some of the main demographic trends in Dublin over the past two decades. While the focus of the research is on the Dublin City Council area the results are placed in the context of the GDA and the State.

Understanding population structure and dynamics is one of the key bases for social and economic planning. More specifically, it is crucial with respect to analysing labour markets and the provision of social services such as education and health services among others. Population dynamics are influenced by a wide range of factors, one of which is the state of the economy. The period since the mid-1990s has been one of tremendous socio-economic and demographic change and the report by Redmond and Williams (2011) aims to document some of the key elements of population change over those years. In particular it describes the key trends in the period 1991-2011, some of the main long-range population forecasts as well as some of the policy implications from these trends. While the report was commissioned by Dublin City Council, the results were comparatively presented in the context of the Dublin Region, the GDA and the State.

The study shows that while nationally the population grew by 8.1% between 2006 and 2011; there were significant regional variations in population growth. In the midland and mid-east

regions, population grew by 12%. Redmond and Williams (2011) suggest that this latter growth reflects a continued dispersal of population beyond the GDA (see Figure 2-8). The Dublin Region saw growth of 7%, slightly below the national average. The Mid-West region only had a growth of 5%, well below the national trend.

One of the issues that arose during this research was the need for the development of a comprehensive evidence base on key socio-economic data for Dublin. The authors highlight that while the Census data is readily available, there is a lack of readily available data on education and health at neighbourhood, city and regional level. Given the importance of the Dublin area in population and economic terms they suggest the development of a comprehensive evidence base which would cover population, housing, the economy, health and education among others.

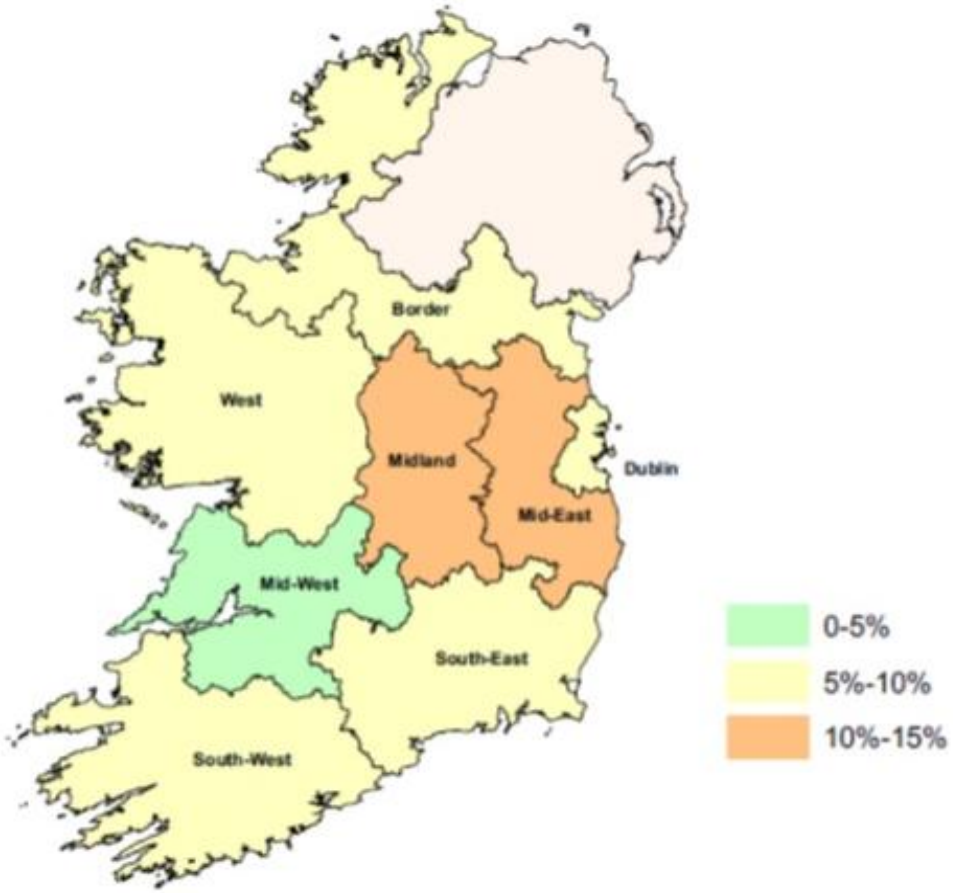

Figure 2-8: Regional Population Change 2006-2011 (Redmond and Williams, 2011)

A Profile of the Working Population of Large Towns

CSO in collaboration with ESRI have examined the towns in Ireland with a working population in excess of 5,000 persons in April 2006 and provided profiles for each of the 27 towns involved (CSO, 2009).

These profiles focus on the principal characteristics of the relevant workers including their commuting patterns, the industries in which they were employed and their educational and socio-economic characteristics.

The analysis draws on the POWCAR dataset. All journeys to work were coded and the detailed geographic data which resulted from this coding exercise was combined with the associated demographic and socio-economic information from the census. For example, Figure 2-9 illustrates the commuting catchment areas of each town specified in terms of EDs.

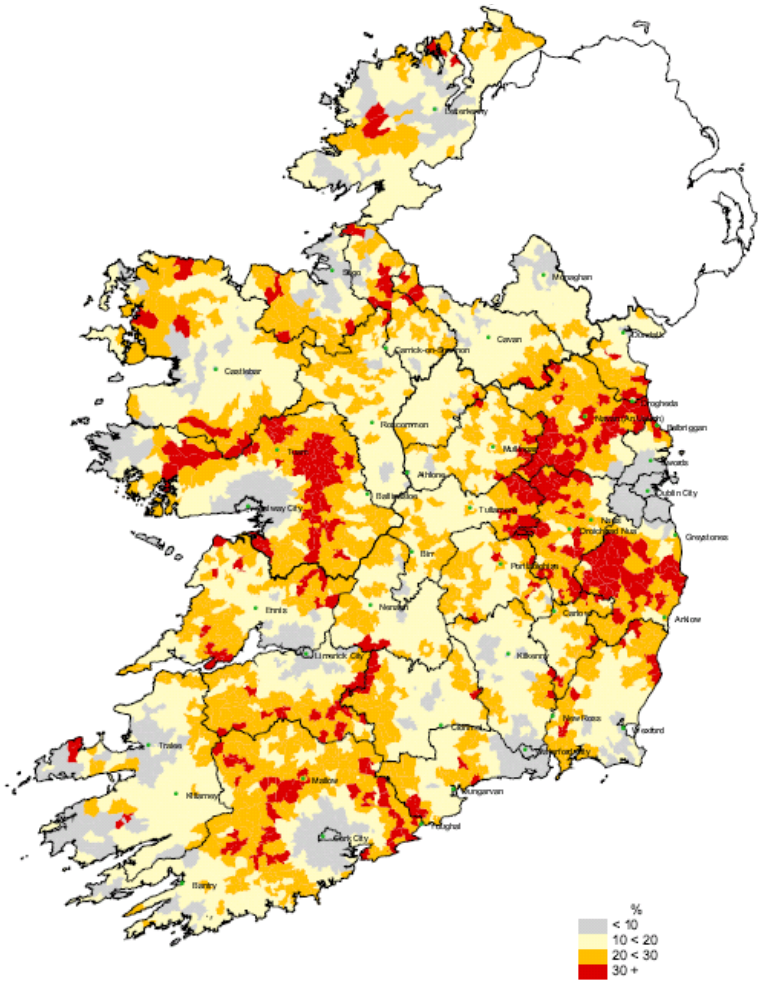

Figure 2-9: Workers in each ED in 2006 who travel 30 km or more to work (CSO, 2009)

Analysis of the Social-Economic Profile of the Greater Dublin Area

The purpose of this study was to provide a comprehensive profile of the Dublin, Kildare, Meath and Wicklow counties. Such a profile is of major importance for policy making at the national, regional and local levels (Morgenroth, 2001).

The study looked at the settlement patterns and distribution of economic activity in the region utilising statistical data up to 2001 including CSO Censuses of Population, Industrial Production, Labour Force and Agriculture, QNHS, Live Register, Forfas employment surveys, a comprehensive database of firms, etc.

The population analysis showed that the GDA counties are quite heterogeneous in terms of their population size and the basic demographic characteristics. For example, Dublin County Borough has a population which is more than four times as large as that of County Wicklow or County Meath.

The analysis on aggregate economic activity has shown that Dublin accounts for a large portion of national output. Both the Dublin and Mid-East regions have improved their relative position occasionally, with regard to Gross Value Added (GVA) but the Mid-East has been growing faster than the Dublin region. The Manufacturing, Building and Construction, and Agriculture, Forestry and Fishing sectors are more important in the Mid-East region than in Dublin where Services are most important. County Meath has the lowest GVA.

The analysis of labour force and social characteristics uncovered interesting differences between areas. More rural areas of counties Kildare, Meath and Wicklow have a lower educational profile than areas closer to Dublin. Such patterns are repeated with regard to the other measures such as social class and unemployment.

The analysis of unemployment showed that this has declined dramatically since 1996. However, there is a large difference between the unemployment rates across space, which results in more moderate unemployment rates due to averaging the differences.

The study produced new data on commuting patterns showing that significant commuting to the city was occurring from locations as much as 60 miles away.

The study made policy recommendations regarding clustering of settlement, urban density and other matters. As many problems were encountered regarding the availability of data at the regional, county and sub-county level, making a serious analysis of some of issues impossible at the regional level, one of the main recommendations was that the providers of official statistics and in particular the CSO be given additional resources to collect more data at a spatially disaggregated level (Morgenroth, 2001).

This is a valuable study, however, the developed profile needs updating as there have been significant changes in the social-economic and demographic situation in Ireland in the last decade. Particularly, a recent research by Redmond and Williams (2011) described in the following section has up-to-date results on demographic trends in Dublin region.

Measuring the Scale and Value of the Creative Industries

In 2009, Dublin City Council commissioned the National Institute for Regional and Spatial Development at the NUI Maynooth to conduct a research project, which aimed at providing insight into the challenges in, and possibilities of, measuring the scale and scope of the creative sector and its value to the City's and Nation's economy.

Based on POWCAR the project estimated that the creative industries in the GDA employ just over 77,000 people or 59% of the national total (10% of total regional employment). The GVA of the creative industries in the GDA is estimated to be about €3.25 billion. This is the first study that provides an estimate of the economic value of the creative industries to the GDA using an industrial classification approach (Curran and van Egeraat, 2010).

The GDA far exceeds other Irish cities, in terms of employment in the creative industries. Further analysis of employment levels in the creative sector in a selection of Irish urban centres shows that, more than industry on average, the creative industries appear to be disproportionately attracted to the largest urban centres in the urban hierarchy. This may suggest that, more than most industries, creative industries derive important benefits from being located in metropolitan centres. For example, the high concentration of advertising firms in the urban centre of Dublin is clearly visible in the Figure 2-10. Therefore, the policy of dispersal of industrial activities, along the lines of the National Spatial Strategy, may be less appropriate in the context of the creative industries (Curran and van Egeraat, 2010).

It is highlighted that, though a number of Irish datasets (e.g. POWCAR, POWSAR) offer great potential for undertaking such an occupations-based study; however, serious data challenges remain. In particular, there is a lack of average income data for detailed occupation groups. At present, earnings data released as part of the National Employment Survey are only provided for broad occupation categories.

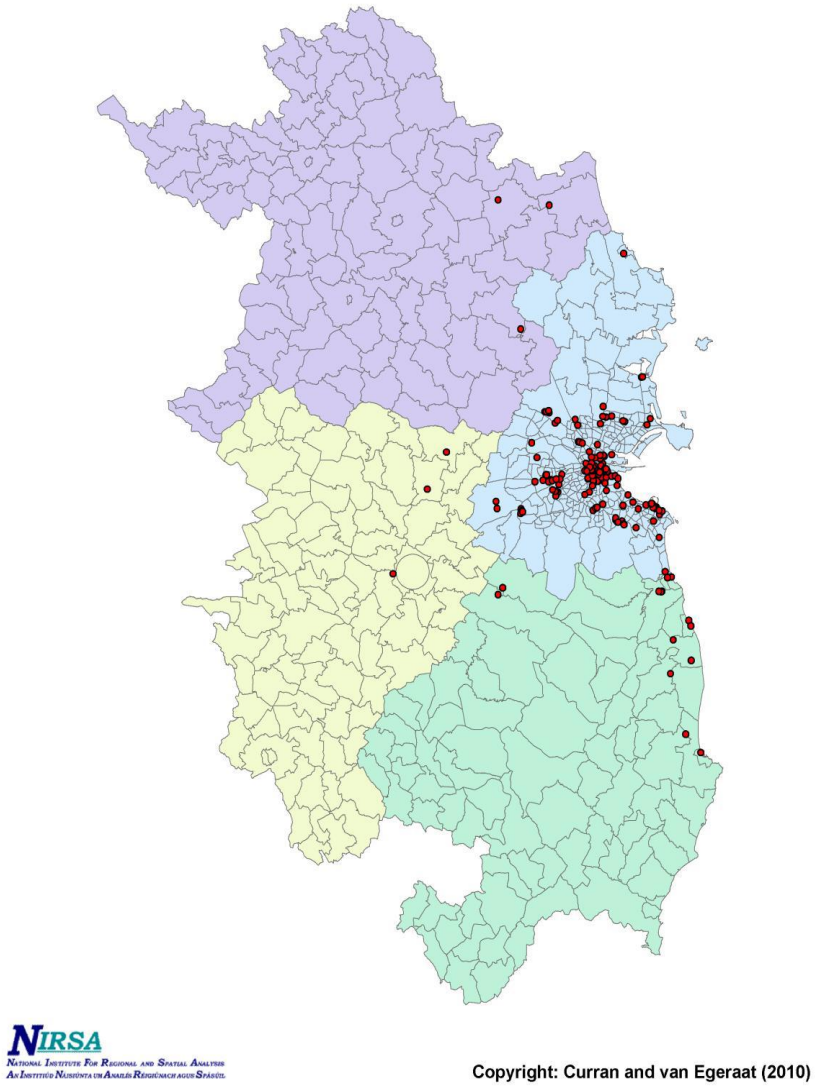

Figure 2-10: Concentration of Advertising firms in GDA in 2009 (Curran & van Egeraat, 2010)

In order to address issues of data availability the following recommendations were provided:

- Approaching the CSO with a view to ascertaining the possibility of accessing a more detailed breakdown of National Employment Survey average income data.
- Exploring the possibility of obtaining Annual Business Inquiry data at NUTS3 (or Dublin Region) level. This dataset is currently only available at NUTS2 level.
- Further developing the spatial dimension of the detailed industry data available in the Census of Industrial Production.

Quality of Life and the Environment

Irish regional policy, as set out in the National Development Plan (2000–2006), aims to reduce this spatial domination and to provide for a better distribution of economic activity and development. The NSS (2002) further articulated this regional policy by proposing that principles of sustainable development should apply and that equal emphasis should be given to economic, social and environmental dimensions if people's quality of life is to be advanced. However, rather little consideration is given to what constitutes quality of life, such that, in practice, policy falls back on conventional strategies to increase investment and incomes.

The study by Bullock et al. (2008) examines objective indicators associated with quality of life in Ireland. These include indicators of environmental quality, income, house prices, health, education and crime. For example, Figure 2-11 Figure 2-11: Disposable per capita income by county (Bullock et al, 2008)demonstrates the spatial pattern of income in Ireland in 2003. Once again, it has to be noted that the data is available only in aggregate at county level. Consequently, the figures for counties Cork, Galway, Sligo and Waterford are exaggerated by the existence of major cities within their boundaries.

The analysis then moves on to compare these objective indicators with subjective indicators as revealed through the use of a public survey and further qualitative analysis based on focus-group discussions. The intention was to compare the objective measures with people's perception of these indicators and their own subjective assessment of personal well-being.

The analysis does not necessarily provide more information on the key attributes of quality of life, but does identify where there are common patterns amongst many respondents. In this respect, the analysis identifies three components of quality of life, each of which was evident in all three locations. These components can be broadly described as (i) 'domestic security', (ii) 'social/leisure' and (iii) aspects of the 'planned environment' (Bullock et al., 2008).

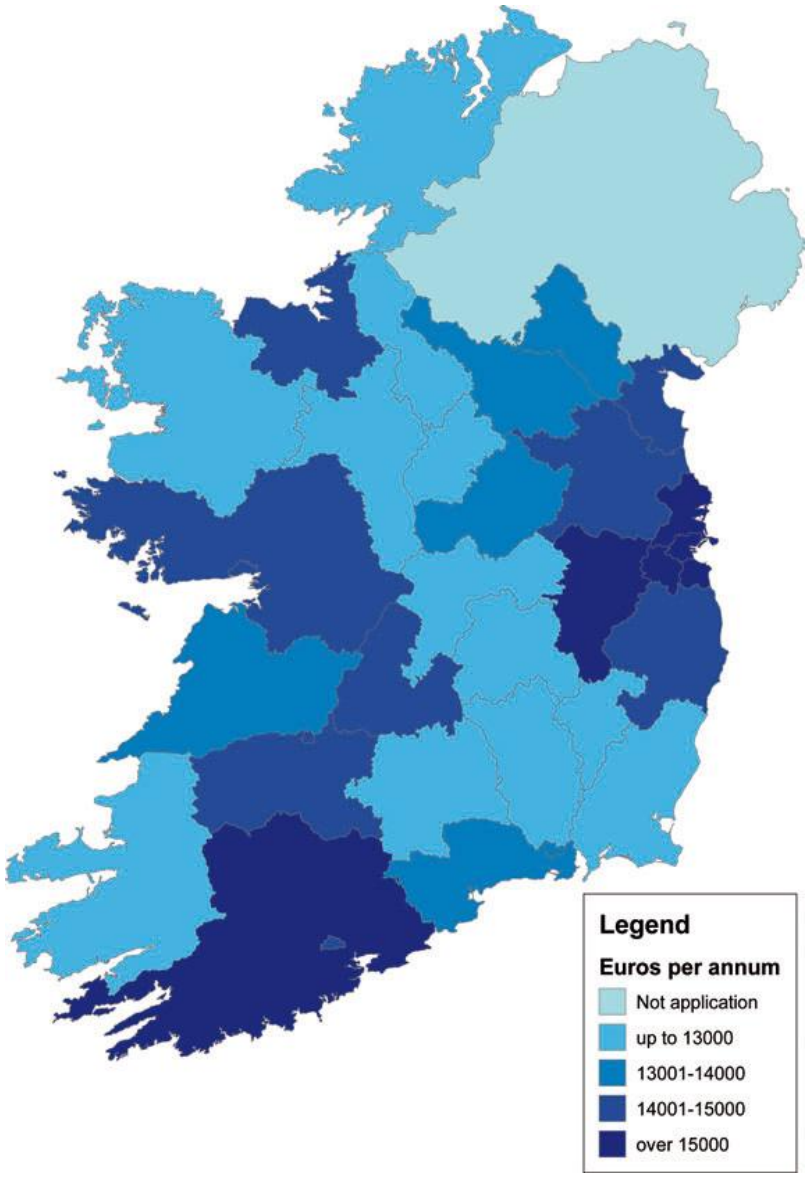

Figure 2-11: Disposable per capita income by county (Bullock et al, 2008)

Territorial Performance Monitoring (ESPON)[1]

The Territorial Performance Monitoring (TPM) targeted analysis is currently being carried out ans explicitly focuses on the European and global challenges that have very specific regional consequences seeking to develop appropriate regional policy response. In total 5 regions, are addressed by this ESPON project, namely, Flanders, Catalonia, North Rhine-Westphalia, Navarra and the Greater Dublin Area.

It addresses macro-challenges and indicators of climate change, energy supply, globalisation and demography, amongst others. It is being compiled under the auspices of ESPON and the stewardship of the DRA through researchers in the AIRO at the National Institute for Regional and Spatial Analysis (NIRSA), NUI Maynooth. Through the facilitation of the DRA and the Regional Planning Guidelines Office of the Dublin and Mid-East Regional Authorities this study will work closely with this research project to maximise synergies and resources for data collation and analysis purposes.

Sustainable Development Indicators and Economic Profiling of the City Region

The Office of International Relations, Research and Special Projects (OIRR) is a research arm of Dublin City Council. One of its primary remits is to benchmark the region nationally and internationally at various temporal and spatial scales. A comprehensive database of regional performance metrics have been developed through this research office since 2007 including national and regional level economic data such as on Foreign Direct Investment (FDI); live register numbers and redundancies; employment statistics as sourced through the CSO's Quarterly National Household Survey (QNHS); competitiveness, knowledge economy and innovation data including research and development and education statistics, and; a suite of international benchmarks measuring business activity, globalisation, connectivity and tourism, amongst other topics. These data will constitute a key part of the data collation and analysis procedures of this study.

In addition, in February 2011, the Dublin Regional Authority (DRA) in conjunction with the OIRR commissioned a study to develop a suite of ideal indicators to measure the sustainable development of the Dublin Region "Sustainability Indicators Framework 2011"[2]. Trinity Haus carried out this study on behalf of the DRA. The development of this suite of 39 Sustainable Development Indicators comes at a time when the investigation of the role and functioning of city regions is high on local, regional and national agendas. There is an acceptance now more than ever that the concept of sustainable development must be incorporated into the functioning of our daily lives. As Ireland, Europe and the World become more urbanised it is central to informed planning that metrics of sustainable development are institutionalised to ensure that we are accurately and comprehensively monitoring the broad spectrum of issues which affect the quality of living of the city region and effectiveness of its socio-economic and environmental functioning. The indicator framework is furthermore complementary to the monitoring and implementation processes of both the Regional Planning Guidelines and city and county development plans creating a shared vision for the region across 10 themes ranging from

[1] ESPON is the the European Observation Network for Territorial Development and Cohesion and was adopted by the European Commission in 2007.

[2] Sustainability Indicators Framework 2011 is published on the website of the Creative Dublin Alliance at http://www.creativedublinalliance.ie. This alliance of diverse urban (city region) leaders from across the helix of academia, local government, NGO's and business seeks to build a network of cooperation that identify, discuss and distribute solutions in response to the challenges that Dublin faces.

"Economic Prosperity and Livelihood", Innovation and Education", "Biodiversity and Environmental Protection" to "Governance, Citizenship and Community Engagement."

This study will be cognisant of this work, supporting multi-stakeholder collaboration and incorporate and populate relevant indicator sets pertinent to the requirements of this study.

Regional Planning Guidelines for the Greater Dublin Area 2010-2022

The Regional Planning Guidelines (RPGs) is a policy document which aims to direct the future growth of the Greater Dublin Area over the medium to long term and works to implement the strategic planning framework set out in the National Spatial Strategy (NSS, 2002).

Of central relevance to this report (Report 1) is the implementation and monitoring programme of the RPGs. A key part of the Planning and Development Amendment Act 2010 is the introduction of a requirement for an evidence based "core strategy" in city and county Development Plans to achieve coherence between the hierarchy of forward plans and to show that the housing strategies and other policies are consistent with the Regional Planning Guidelines and the National Spatial Strategy. In order to ensure that this consistency is achieved, in particular between the housing and settlement strategies of the RPGs and city and county development plans, monitoring and implementation structures have been framed and are being realised.

As part of this monitoring process to track progress, consensus building and the realisation of the sustainable growth scenario for the GDA monitoring and evaluation indicators to measure the success of the recommendations and progress of the RPGs have also been developed. *Dublin's Place in the Irish and Global Economy, 2012* will incorporate relevant outputs and data generated through the aforementioned implementation and monitoring programme.

Retail Planning Strategy for the Greater Dublin Area

The last *"Review of the Greater Dublin Area Retail Strategy"* was carried out in 2008. The main objectives of this study were to review, update and extend to 2016 the existing Retail Strategy for the GDA and as part of this to provide strategic guidance to promote the development of a vibrant and competitive retail sector, whilst protecting the integrity, vibrancy and viability of existing centres.

The data produced and analysed for this study included quantitative (and qualitative) need for future retail development based on demand as measured by spend per capita per population and inflow expenditure from tourism and long distance trips and supply of retail floor-space as per existing and planned retail development, amongst other variables. Quantitative need was calculated for both convenience and comparison goods and detailed across the GDA according to "Zones" which are amalgamations of Electoral Divisions. These zones are broadly analogous to Dublin Transportation Office (DTO, now NTA) zones.

These data may be incorporated into future opportunity mapping analyses though issues of the lag time from this review to the present and geo-coding need to be carefully considered. It should be furthermore noted that the Department of Environment, Community and Local Government published "Draft Retail Planning Guidelines" in November 2011 and that Forfás, the economic policy advisory agency, published a study "Review of the Economic Impact of the Retail Cap" in 2011 and these will be considered in Report 3.

Note on "The Irish Statistical System: The Way Forward"

The National Statistics Board (NSB) Strategy is titled Strategy for Statistics 2009-2014. It is focussed on the development of the Irish Statistical System and built on 5 key priorities, ensuring reliability and coherency of data; the use of statistics in policy making across government departments and the use of data to improve resource efficiency; consistent classification variables and data matching; the provision of data fit for purpose and filling critical data gaps; and, improving accessibility to data and use of CSO statistics.

In this regard Report 1 of this study fulfils and uncovers many of the respective objectives and challenges outlined within "*The Irish Statistical System: The Way Forward.*" The latter report points up the benefits of exploiting and developing new data output through the amalgamation of distinct datasets. For example, "Jobs Churn Data" provides insights into the dynamics of the Labour Market. By data linking P35 files from the Revenue Commissioners with the Client Record System from the Department of Social Protection and the Central Business Register of the CSO it can:

- Profile new entrants to the labour market by demographic metrics, location of work, level of income and residence and sector of the economy they are working in.
- Profile those who have lost their jobs and those who have found employment according the same metrics.
- Profile citizens who have remained in employment.

Priority action areas have also been identified including more widespread usage of Personal Public Service Numbers (PPSN), the development of a Unique Business Identifier and associated public sector business register and the use of a standard geo-spatial coding system. The use of unique identifiers for all persons, businesses and institutions, and buildings and dwellings is seen as the basis for more refined statistical analyses.

In addition, the promotion of data share to inform policy and support intelligent decision-making, networking between data holders, improving service delivery and developing response mechanisms to policy data needs are highlighted as key positive consequences of an efficiently functioning, streamlined and linked statistical system.

A range of new outputs have been recently compiled as a result of linked administrative and statistical data such as:

- Live Register Flow Analysis
- Vehicle Registrations
- Total Road Vehicle Kilometres
- Structural Business Statistics – Insurance, banking and enterprise demography
- Rail and Aviation Statistics

A cross-government strategy for data linking is pinpointed as central to improved service delivery, more effective policy formulation and as being consistent with best practice and recommendations in the 2008 OECD review *Towards an Integrated Public Service*[1] and the commitments in the Government response *Transforming Public Services*[2]. The former, encourages greater public sector cohesiveness to facilitate the more effective delivery of services to citizens and the achievement of wider societal goals. The latter endorses the citizen-centric approach to service delivery.

[1] OECD, 2008. Towards an Integrated Public Service, OECD Public Management Reviews –Ireland. OECD.

[2] Department of the Taoiseach, 2008. Transforming Public Services- Report of the Taskforce on Public Services, Department of the Taoiseach, Government of Ireland Publications, Dublin.

3. POTENTIAL NEW APPLICATIONS

3.1 Opportunity Mapping

Census, surveys and other research projects described above provide large amounts of data on the social-economic situation in the RoI. Some of these datasets are available in spatially disaggregated level (e.g. ED or address) allowing advanced geo-spatial analysis. There are numerous indicators developed and calculated based on these datasets (CSO, 2009; Tol et al, 2009; Morgenroth, 2009). However, usually each indicator is analysed and mapped separately. Even though, overlay of separate indicators is normally applied, this provides a complex map, which is often hard to interpret. In such cases, the opportunity mapping intends to provide a comprehensive view of any number of indicators.

Opportunity mapping is a research tool used to understand the dynamics of "opportunity" within metropolitan areas. It aims to illustrate where opportunity rich communities exist and to understand what needs to be remedied in opportunity poor communities. Opportunity mapping builds upon the rich history of using neighbourhood based information and mapping to understand the challenges impacting neighbourhoods. It is a way to conceptualize and visualize the varying levels of access to the opportunities which exist throughout counties and regions. Having high access to opportunity means having the ability to obtain a quality education, being able to have a safe and affordable place to live, having access to employment and transport networks, and more. Comprehensive opportunity maps display the composite of many indicators for the region. Identification as high opportunity in these maps indicates areas that generally performed well on all of the considered sectors which can be education, employment, housing, accessibility, health, environment, and other (Reece et al, 2010).

To develop a map of opportunity for Ireland, we can use variables that are indicative of high and low opportunity in the country. A central requirement of indicator selection is a clear connection between the indicator and opportunity (Reece et al, 2010). Indicators could either be impediments to opportunity (which are analysed as negative neighbourhood factors, e.g., high neighbourhood poverty) or conduits to opportunity (which are analysed as positive factors, e.g., an abundance of jobs). These multiple indicators of opportunity are assessed at the same geographic scale, thus enabling the production of a comprehensive opportunity map for the region.

The opportunity mapping initiative for Ireland can be used to explore the distribution of population and businesses within Ireland's geography of opportunity.

3.2 Business Cluster Spatial Analysis

Knowledge of the business location and co-location patterns provides an important platform for an investigation of the factors underpinning future competitiveness of different industries in the region and country. Analysis of the spatial patterns of company location can identify established or emerging "clusters" and the related backward and forward linkages within Ireland. An example of this type of research for Ontario, Canada, is provided in Davis (2009) and for Singapore by Gwee (2009).

As described above, GeoDirectory provides geographic coordinates of all addresses in RoI. This includes the electronic register of business addresses and geocodes allowing identify the location of relevant businesses. The businesses in the GeoDirectory are classified according to NACE Rev2 classification: 19 major sectors (A-S) with more than 300 classes (Appendix E).

The big advantage of the GeoDirectory compared with commercial business directories is that it includes the geographic coordinates and addresses not only for headquarter or a main branch of a company, but also for all other branches which has separate address. Such information can be used for identification of business clusters in RoI by industry type.

GeoDirectory is available from 2003. Thus it will allow study changes of patterns in business clusters between 2003 and 2011.

Furthermore, POWCAR database can be used for definition of number of employees by their industrial groups in these clusters. Employment density maps generated from POWCAR can be overlaid with business clusters developed from GeoDirectory to identify business clusters with high or less concentration of workers.

Additionally, the employment density and business cluster maps can be overlaid with CORINE land cover maps. CORINE land cover classification includes 11 artificial classes, 11 agricultural classes and 29 other classes (Appendix H). These can be further matched with the POWCAR-GeoDirectory standardised industrial group.

Finally FAME database can be used for further statistical analysis of revenue and number of employees by industry type. As the FAME provides only general information per company and does not distribute it by separate branches (if they exist), the outputs will not have spatial component, but will be more general for the whole country.

It's should be noted that, industry classification in POWCAR, GeoDirectory, CORINE and FAME do not fit perfectly (see Table 2-6 and Appendices C & E). Therefore, the industrial grouping should be standardised for combined analysis of these datasets.

Data obtained from intersection and overlay of these datasets can be used in further statistical analysis, such as ordinary or geographically weighted regression. Moreover, linking POWCAR and GeoDirectory datasets with land cover maps opens wide possibilities for future development assessment using the land use change model MOLAND.

3.3 Land Use – Transport Modelling with MOLAND

There are costs and benefits associated with physical planning decisions; and the exact direction pursued will be decided by the interaction between planners, policy makers and the public working together. Infrastructure, development, environmental and zoning decisions should be undertaken on the basis of a rational methodology which incorporates inputs including evidence of population and employment projections; land use surveys, assessment of housing needs; the demand for retail space and community facilities (including education and open space/ amenities provision). This process should culminate in the quantification of future urban land demand and its location. In addition, the suitability of the land itself in terms of topography, physical characteristics and the linkages to the existing urban area are essential criteria in rational decision making. The MOLAND model allows diverse policy options to be evaluated before concrete decisions are made and provide a useful basis for discussion on the issues facing policy interests.

In 'A New Transport Policy for Ireland 2009 – 2020' (Department of Transport, 2010) the Government reaffirms its view that transport and travel trends in Ireland are unsustainable. It is expected that as a result of current policies, congestion and transport emissions are likely to increase and that economic competitiveness and quality of life may decline. In 2005 a capital investment framework Transport 21 was launched under the Irish National Development Plan, through which the transport system in Ireland was intended to be developed, over the period 2006 to 2015. Transport 21 planned to provide seven light rail and two metro links in the GDA

by 2016. Though some of the infrastructure has already been partially implemented, the recent recession and current economic situation in the country forced the cancellation or postponement of most of the projects. This includes projects such as Metro North, Dart Underground, the city centre Luas link, etc. In formulating its new national development plan, the Irish Government needs to weigh up what makes sense for Dublin in transportation terms as only one of these projects is now likely to proceed.

Given these issues, Spatial Decision Support Systems (SDSS) integrating transport and land use dimensions have great potential in assessing policy options. Such systems are especially valuable in a time of great economic uncertainty when the need to maximise the use of scarce resources has never been greater.

The transport model described in section 2.4 is currently used by the NTA to assess the impacts of major land use and transportation developments proposed for the GDA over the next few years. However, as mentioned before, NTA transport model has no integrated dynamic land use model. Here is where the land use model MOLAND can provide valuable information about expected land use changes in the region for the next 20-30 years. Moreover, recently the MOLAND was enhanced with a classical four step transport model (RIKS, 2007): the land use model serves as an input to the transportation model, whilst the transportation model again influences the land use model by means of a local accessibility term. Hence the MOLAND Transport model is a dynamic model. Both transport and land uses are calculated for every time step (yearly).

The MOLAND transport model is not as detailed as the NTA model as it is anticipated to be used more for regional analysis (for comparison, the MOLAND model uses 44 transport zones for the GDR, while the NTA model uses more than 600 zones). However, the land use maps generated by MOLAND for various regional development scenarios can be used in NTA transport model to evaluate the effect of these scenarios on traffic as well as the transportation infrastructural needs of the region in case of such scenarios.

4. RECOMMENDATIONS

This study aimed to clarify the available data resources and outcomes from recent relevant studies which can help to analyse the place of Dublin city region in the Irish and global economy.

The following initial recommendations are made based on the investigation of the datasets and research findings:

Complementing existing initiatives from EU to local level and building formal arrangements

1. To align with EU and national policy and to provide input into complementary regional and/or national research activities such as *Dublinked,* "Jobs Churn Data" from Revenue and the CSO Central Business Register and the All-Ireland Research Observatory (AIRO).
2. There is significant potential to contribute harmonised geo-coded datasets as part of fulfilling obligations as specified under the INSPIRE Directive.
3. Close collaboration between main data holders is necessary for using similar data standards and identifiers. This will make integration of the datasets held in different organisations significantly easier to access and will boost the overall value of the data. It is therefore highly recommended that the potential for new formal arrangements and partnership approaches is explored and that barriers to data usage such as data protection concerns and the related need for risk management over risk avoidance are addressed.
4. In this regard data collated during this study from the main data holders can therefore potentially lay the building blocks for more formal relationships, eliminating duplication of effort whilst the study itself provides a manifest and tangible policy output.
5. The analysis of datasets and the collation of additional primary research data will be used in the preparation of analytical reports on the future role of Dublin. This must involve engagement with stakeholders in both the public and private sectors.

Building a legacy

6. To propose a city region technical working group and community of practice for the purposes of data sharing and policy formation, incorporating regional, city and county planners, academic researchers and policy analysts from the regional or national offices of the ESRI, Forfas, the CSO, Local Government Services Management Board, and the Department of the Environment, Community and Local Government. This should be part of broader initiatives to maximise the benefits of the outputs of this research and align related research with existing monitoring systems.
7. To use the outputs of this data collation exercise and Reports 1 and 2 as part of a broader initiative of developing a multi-disciplinary methodological guide for urban scale analysis.

Building and cataloguing datasets

8. Data sharing portals such as Dublinked and AIRO should be enriched with comprehensive data covering whole of Ireland and over extended time periods.
9. To facilitate data share and to maximise the benefits of analysis to policy development barriers to usage such as charging excessive fees between public sector bodies and confidentiality arrangements (between public sector bodies) should be reassessed and aligned. Publicly sourced data such as for Small Area Boundaries[1] should be available to the research community at affordable minimal cost.
10. There is a need to better catalogue relevant meta-data for this study and to create a city region meta-data portal for these data.
11. There is a concurrent need to create a geo-portal for spatial datasets which are relevant to the socio-economic functioning of the Dublin city region, its hinterland and the regions of the State.

Data scaling, harmonisation and coding

12. There is potential to align and cross-reference multiple data sets from across the city region within the scope of carrying out bespoke socio-economic analysis of the Dublin city region within national and global contexts.
13. To lobby to make data available: there is a significant need to make available and capture accurate socio-economic and urban related information at a policy and planning relevant geographic scale (at least on ED level). This will enhance the appliance of these data in advanced geospatial analysis and will improve the prospects of their integration with other datasets using GIS.
14. In this regard, there is potential to differentiate the expectant outputs of various scalar levels of data from point source and electoral divisions to broader NUTS II and NUTS III and to develop cases to main data holders such as the CSO for more refined data availability on the basis of the added value to policy formation.
15. Standardisation of the industrial categorisation as well as geographic location identifiers used in different databases is necessary to make them compatible and allow combined analysis of various datasets.
16. To reflect emerging growth sectors and for the purpose of business clustering and hotspot analysis it is recommended to merge, where feasible, series of NACE codes and subsections to create an agreed suite of categorisations in the areas of: the Green/Clean Technology sector; a clearly defined Creative Industries sector; Agri-Food; Bio-Pharma; ICT and Financial Services; ICT and Gaming.

Policy Formation

17. In the context of policy development to provide new analysis, visualisation of planning scenario's and an evidence base of relevance to policy formation. To furthermore re-affirm the need for a standard geo-spatial coding system and demonstrate the practical benefits of doing this in the context of providing an evidence base for macro and micro economic analysis of a metropolitan city region. In this regard this study has the potential to fulfil national policy as outlined by the National Statistics Board (NSB, 2011).

[1] Small Areas boundaries are used by CSO in the compilation of statistics for Census 2011.

18. Within the scope of the study the benefits to policy formulation of system wide data coherence and multi-stakeholder cooperation across Local Authorities Government departments and State agencies should be clearly outlined and demonstrated. This will therefore assist the NSB recommendation for a national cross-government data strategy.
19. The benefits of GIS and spatial modelling application to policy formation should be supported at all levels and demonstrated and used wherever possible. For example, in this study through the implementation of spatial cluster analysis, density and opportunity mapping as well as application of the MOLAND model.
20. To investigate and cost benefit the use of new and emerging applications and management systems across policy areas and sectors.

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APPENDICES

A. Data Sources and Limitations

Central Statistics Office (CSO)

Website: http://www.cso.ie

The CSO is responsible for the collection, compilation, extraction and dissemination of high quality data for the statistical purposes of information relating to economic, social and general activities and conditions in the State. It is responsible for co-ordinating official statistics of other public authorities and for developing the statistical potential of administrative records. CSO also serves the needs of the wider national and international community (i.e. business, EU, international organisations, media, researchers, and the public generally) for impartial and relevant information on social and economic conditions. Particular attention is paid to the specialist needs of business and the research/academic community for more detailed and focused data.

The CSO holds rich statistical database covering the following key areas:

People and Society
- *Population*
- *Births, Deaths and Marriages*
- *Health and Social Conditions*
- *Housing and Households*
- *Education*
- *Crime and Justice*
- *Information Society*

Labour Market and Earnings
- *Labour Market*
- *Earnings*

Environment and Climate
- *Environment*
- *Climate*

Economy
- *Balance of Payments*
- *National Accounts*
- *External Trade*
- *Prices*
- *Key Economic Indicators*
- *IMF Summary Data-Ireland*

Business Sectors
- *Agriculture and Fishing*
- *Construction*
- *Industry and Services*
- *Science and Technology*
- *Tourism and Travel*
- *Transport*

The CSO also has a useful annual report summarising relevant key data called Measuring Ireland's Progress (CSO, 2010) as well as datasets on Live Register from the Department of Social Protection.

Some of the challenges of using these datasets in advanced spatial analysis is related to the geographic scale data provided and sample size of the datasets (e.g. QHNS). On the scalar issue:. only portions of CSO data are available for public or researchers in detailed geographic scale, for example Electoral Divisions (ED) level. And these are mainly the data coming from the population censuses, and therefore available for particular censual years only. Most of the data are provided in local authority (LA) or state level only. Though some of these datasets can be obtained in more detailed level by a special request; this is usually costly and time demanding, being not always feasible for researchers. This often makes serious analysis of some issues impossible at regional or at a more disaggregated level (Morgenroth, 2001).

CSO use various territorial divisions of the country such as townlands, EDs, town and rural areas, counties and cities, local electoral areas, etc. The smallest administrative area for which

population statistics are published is the ED. In urban areas each ED is clearly defined and in rural areas each ED consists of an aggregation of entire townlands. There are 3,440 EDs in the State. EDs are aggregated to give Towns (or Cities where appropriate) and Rural Districts/Areas which, in turn, build up to counties (CSO, 2009c). In the case of County Dublin, however, it is not possible to compile rural area figures because of extensive revisions that have taken place in the ED boundaries over the years. For administrative purposes it is often necessary to compile population figures for towns within their legally defined boundaries. However, many of these towns have expanded beyond these legally defined boundaries. As a result large numbers of people in the communities for which these towns are the nuclei would be excluded if the coverage were confined strictly to legally defined boundaries (CSO, 2009c). The variation in the sizes of ED is another issue especially in newly emerging urban growth areas across Ireland in particular in Fingal.

Another challenge of using CSO data in spatial analysis is concerning to joining tabular data to GIS layers. Though CSO in collaboration with Ordinance Survey Ireland (OSI) provides administrative boundary maps of RoI in GIS format[1], there is no common identifier used in these maps and the tables extracted from CSO database. Usually the name of geographic area (e.g. ED or county) is the common field between them; but as a text field, they are not suitable for data matching, especially taking into consideration frequent cases of different spelling used for the same name. As a result, linking CSO tables to GIS maps becomes unnecessarily complicated and time consuming. Standardisation of identifiers used in the provided GIS files and statistical tables will make linking them straightforward and will increase data use in geo-spatial analysis. According to non-official discussions, the CSO is currently working on the problem and will make Census 2011 data tables compatible with boundary files.

Economic and Social Research Institute (ESRI)

Website: http://www.esri.ie

The ESRI is one of Europe's leading research centres in the social sciences, focusing on research on economic and social change in Ireland in the new global context. Over the years they have collected and published primary data for research purposes in Ireland, through the use of administrative records and through state-of-the-art surveys, examples include:

- Adapting to Diversity: Irish schools and newcomer students, 2009
- School Leavers survey, 1980-2007
- Survey of Employees' Attitudes and Expectations of the Workplace, 2003
- National Survey of Housing Quality, 2001/2002
- Living In Ireland panel survey, 1994-2001

In addition, the Institute manages two national data sets (HIPE[2] and NPRS[3]) on behalf of the Health Service Executive as well as a databank of Economic Time-Series, which is based on the data contained in the National Income and Expenditure 2006 volume.

ESRI holds the Economic time series databank which also contains a very wide range of other time series that have been used in constructing the Medium Term Model (HERMES[4]) and in a

[1] http://census.cso.ie/censusasp/saps/boundaries/census2006_boundaries.htm

[2] Hospital In-Patient Enquiry Scheme is a computer-based system designed to collect demographic, clinical and administrative data on discharges and deaths from acute hospitals nationally.

[3] National Perinatal Reporting System aims the provision of national statistics on perinatal events.

[4] The HERMES macroeconomic model is a tool for understanding how the Irish economy behaves – what drives it and how it is likely to respond to changing circumstances at home and abroad. It has been used as an essential tool in the ESRI's medium-term reviews.

range of other related research. The data are all annual time series. While it has series from at least 1960 to the latest published date available, there are many exceptions. There are also a few series that go back to earlier dates, the earliest dating from 1927 (migration). However, these data are provided at State level only, limiting its applications in regional spatial analysis.

ESRI, with financial support from the Environmental Protection Agency, has also developed a Sustainable Development Research Model for Ireland: ISus. The purpose of this model is to forecast environmental emissions (to air, soil and water) and natural resource use (energy, land, water) until 2025. Production sector emissions are forecasted using emission intensities. ISus uses the median change in the past emission intensities per sector and substance to project future emission intensities. ISus further uses the projected sectoral output from the HERMES model, downscaled to the 19 sectors in the ESRI Environmental Accounts (Lyons et. al, 2008).

Some other ESRI datasets include spatial information but are available only for one or two years. For example Housing Quality dataset from the Irish National Survey of Housing Quality includes information at local authority level and is available for 2001/2002 (see section 2.2).

Ordinance Survey Ireland (OSI)

Website: http://www.osi.ie

OSI is the national mapping agency of the RoI. Its primary product is mapping services. OSI produces a comprehensive range of urban, rural, tourist and leisure maps at a variety of scales. These maps are produced in digital form as well as on paper. The base data used to create the map series is also used to produce other products such as aerial photography and digital terrain models.

OSI licenses its data to a wide range of customers from both the public and private sectors for use within a wide range of business and GIS. However, OSI's level of business with the education sector is quite low, and this has been attributed to the suggestion that many schools and other educational institutions are unable to afford the prices charged for the maps in which they might be interested, despite the fact that the Service Level Agreement governing OSI specifically requires OSI to offer discounts to education sector clients (Horwath Consulting, 2007). It is worth comparing this position with that in Britain, where Ordnance Survey GB has specific provision for making its services and products available to schools on a deeply discounted basis, and does so in a targeted way.

Irish Social Science Data Archive (ISSDA)

Website: http://www.ucd.ie/issda

The ISSDA is Ireland’s leading centre for quantitative data acquisition, preservation, and dissemination. Based at the UCD Geary Institute, its mission is to ensure wide access to quantitative datasets in the social sciences, and to advance the promotion of international comparative studies of the Irish economy and Irish society.

ISSDA holds a wide, and growing, range of quantitative data provided by CSO, ESRI, Teagasc, and other data providers for redistribution to the academic and non-profit research sectors. Most data held by ISSDA can be ordered via the request forms accessible on the web pages for the respective datasets. Datasets are usually distributed via the post, or through ISSDA Nesstar platform. Access to ISSDA data for use in teaching or unfunded research is free in most cases.

Data usually is provided in SPSS format, though it may also be possible to get the data in SAS, Stata, or comma separated formats.

Though most of the datasets have geographic component, no GIS files are provided. And as the data sources are diverse, there is no consistency between the geographic names in different datasets. So it demands a lot of effort and time to standardise and link different datasets provided by ISSDA. As application of GIS by social scientists is becoming more popular, standardisation and geo-referencing of the ISSDA data archive will boost its potential significantly preventing duplication of efforts by different researchers and creating new perspectives for data use.

National Transport Authority (NTA)

Website: http://www.nationaltransport.ie

The NTA is a statutory body established by the Minister for Transport and at a national level, has responsibility for securing the provision of public passenger land transport services. The NTA also has responsibility for the development of an integrated transport system within the GDA and nationally, including strategic planning of transport, promoting cycling and walking, provision of public transport infrastructure and effective management of traffic demand.

The NTA has a well-developed GIS database. It is the custodian of one of the largest Transportation Models in Europe. The model simulates people's travel patterns and behaviour within the GDA during the morning peak and afternoon off-peak periods. It provides a wealth of transportation statistics, trends and forecasts of how travel demand and travel patterns will change as the region continues to grow and develop over the next 10 to 20 years. More details on the transport model capabilities are provided in the Section 2.3.

Environmental Protection Agency (EPA)

Website: http://www.epa.ie

The EPA has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection. The agency ensures that Ireland's environment is protected, and monitors changes in environmental trends to detect early warning signs of neglect or deterioration.

The EPA is committed to being open and accessible. A large body of information about the environment and the agencies' activities is available in leaflets, publications and reports. EPA's Environmental Research Centre's Environmental Research Data Archive supports a fully web-based interface called SAFER-Data. It provides any related datasets or information objects that are publicly available for download, such as CORINE land cover, Ireland's National Greenhouse Gas Inventory, Quality of Life and the Environment in Ireland, Archive of Ozone Monitoring Data for Ireland, and so forth. The user friendly interface, frequent updates and metadata provided for each datasets make the system quite effective and useful.

Department of the Environment, Community & Local Government (DECLG)

Website: http://www.environ.ie

The DECLG is responsible for the quality of the environment, for housing and other infrastructure, for physical and spatial planning, and for local government. Its mission is to promote sustainable development and improve the quality of life through protection of the environment and heritage, infrastructure provision, balanced regional development and good local government.

The Department has developed a database to track the on-going work on resolving unfinished housing developments. It provides housing statistics datasets through the CSO website. Most of

the datasets are provided on state level, a few are available on local authority or major city level. These data are provided through CSO online system. However, there are no unique identifiers used in these tables which could be used to link the tables with other data or GIS boundary maps provided by CSO. Instead the county names can be used, but this may require manual adjustment of the names. Property and construction indicators are available in the detailed way at local authority level. Important indicators include housing completions, commencements and planning permissions.

Department of Social Protection (DSP)

Website: http://www.welfare.ie

The Mission of the Department is to promote active participation in society through the provision of income supports, employment services and other services. It plays a key role in supporting those most in need, including children and their parents, people who are unemployed and ill, people with disabilities and the elderly. Each week approximately 1.4 million people receive a social welfare payment and, when qualified adults and children are included, a total of almost 2.1 million people benefit from weekly payments.

DSP provides Live Register datasets through the CSO data portal by month, broad age groups, sex and 169 Social Welfare Offices. However, at present the areas served by Social Welfare Offices do not correspond to specific geographic boundaries and registrants at a given local office do not necessarily reside within a precisely delineated area (e.g those signing at the Ballyfermot office do not necessarily have to live within the Ballyfermot area but may be from surrounding areas such as Palmerstown and Ronanstown that might be nearer to another office).

DSP also provides monthly statistics on redundancy by employment sector, geographical area and part-time employees. Geographic areas cover county level as well as Dublin postal districts.

Department of Education and Skills (DES)

Website: http://www.education.ie

The mission of the DES is to provide high-quality education, which will enable individuals to achieve their full potential and to contribute to Ireland's social, cultural and economic development.

DES holds education statistics including primary, secondary and third level education and key indicators. These datasets are provided through the CSO online data sharing system. Though most of the data are available on state or county level, there are some datasets by school locations which could be developed to make them applicable in spatial analysis.

Higher Education Authority (HEA)

Website: http://www.hea.ie

The HEA is the statutory planning and policy development body for higher education and research in Ireland. The HEA has wide advisory powers throughout the whole of the third-level education sector. In addition, it is the funding authority for the universities, institutes of technology and a number of designated higher education institutions.

The HEA holds statistics on students including new entrants, undergraduate and postgraduate enrolments, graduates of HEA institutions, etc. The statistics are mainly provided on state level or by institutions in MS Excel or PDF files. Some datasets are available on county level too. Using GeoDirectory the data for institutions can be linked to their location for GIS analysis.

Health Service Executive (HSE)

Website: http://www.hse.ie

The HSE delivers health and personal social services in RoI, through medical professionals and hospitals and through a network of Local Health Offices, health centres and clinics at community level.

HSE hold data on health services and infrastructure in the state. HSE initiated the development of the Health Atlas Ireland which is an open source application bringing health related datasets, statistical tools and GIS together in a web environment to add value to existing health data (see Section 2.4 for more details).

Its user friendly online FactFile system provides information on the health status of the population, county by county. HSE also provides an online mapping tool, which gives a snapshot of health in an area in the country. The data presented are based on currently available statistics and existing data sources that are available at county level. Content is updated on a regular basis.

Forfas

Website: http://www.forfas.ie

Forfás is Ireland's policy advisory board for enterprise, trade, science, technology and innovation. It provides independent research, advice and support in the areas of enterprise and science policy. This work informs the Department of Enterprise, Trade and Innovation and wider Government in its responses to the fast-changing needs of the global business environment.

Forfas has various relevant reports and publications covering research, development, enterprise, business expenditure and other statistics in Ireland.

Forfas also holds and formulates a repository of the agency assisted business (see IDA and EI described below) active across the State. The availability of these data is being considered and will be reported on in due course.

Enterprise Ireland (EI)

Website: http://www.enterprise-ireland.com

Enterprise Ireland is the government organisation responsible for the development and growth of Irish enterprises in world markets. It works in partnership with Irish enterprises to help them start, grow, innovate and win export sales on global markets. In this way, EI intends to support sustainable economic growth, regional development and secure employment.

EI publishes various reports and strategies including sector, country, seed and venture capital reports, etc., which contain valuable information on businesses in Ireland.

IDA Ireland

Website: http://www.idaireland.com

IDA Ireland's current strategy is based on a policy of attracting investors who are seeking locations for advanced manufacturing or office based activities which depend on highly skilled processes or are involved in high value added activities e.g. ICT, knowledge based industries and biotechnology. Its annual reports and publications contain valuable information on foreign investment in Ireland.

Meetings are scheduled to clarify available data resources at Forfas, Enterprise Ireland and IDA Ireland. Thus information in these sections will be updated later.

Companies Registration Office (CRO)

Website: http://www.cro.ie

The Companies Registration Office is the central repository of public statutory information on Irish companies and business names. The CRO operates under the aegis of the Department of Jobs, Enterprise and Innovation.

The CRO supplies data in bulk format under licence. The data concerned are basic company information in respect of all companies on the register. However, the data are not geocoded and does not necessarily include everyone, i.e. sole trader data.

Office of Public Works (OPW)

Website: http://www.opw.ie

The OPW was established to carry out a wide variety of public works, such as the construction of public buildings, roads, bridges and harbours. These projects not only increased economic development during the nineteenth and early twentieth centuries, but also provided much needed employment. The present day OPW has retained many of its original functions and has acquired new roles. It is responsible for the restoration and preservation of many prestigious state buildings, the acquisition and fitting out of office accommodation for Government Departments, the construction and maintenance of Garda stations and prisons and the arterial drainage and flood relief programme. Its core services are property maintenance, property management, architectural and engineering services, heritage services, project management and procurement services.

The OPW is the lead agency for flood risk management in Ireland. It provides extensive background and information on flood risk in Ireland and the flood risk management services provided by the OPW, including details of recently completed, ongoing and planned programmes and projects. It also provides access to sources of detailed information, such as flood maps and hydrometric data.

Revenue

Website: http://www.revenue.ie

The Office of the Revenue Commissioners was established by Government Order in 1923. There are in excess of 100 Revenue offices countrywide with a staff complement of over 6000 approximately. Its core business is the assessment and collection of taxes and duties. Revenue's mandate derives from obligations imposed by statute and by Government and as a result of Ireland's membership of the European Union.

Revenue publishes Annual Statistical Reports which contain detailed information (in the form of text, tables and notes) on all the taxes and duties for which the Office of the Revenue Commissioners is responsible. The summaries of legislation and the brief descriptions preceding certain statistical tables are presented to assist the reader and should not be taken as a precise interpretation of the law.

For the purposes of this study especially interesting is the VAT registration data provided by NACE Rev 1.1 classification. However, it must be emphasised that these are VAT registrations and should not be considered as business start-ups and cancellations, e.g. a VAT cancellation may mean that a trader registered in error not that a business has failed.

Other Public Agencies

Other local authorities in the country provide data which potentially could be linked in the future to the existing Dublin city datasets. In addition, specific government departments such as the Department of Communications and Department of Transport have important data on infrastructure essential to economic development such as broadband network and transport access. The Higher Education Agency (HEA) has data on third level qualifications and information on school leavers is available through the HEA Central Applications Office which deals with university applications.

B. Socio-Economic Datasets

Small Area Population Statistics (SAPS)

The CSO normally conducts a population census every 5 years in RoI. The data collected in these censuses provide the most reliable indicators on population trends in the country. They also contain rich set of information on other social and economic indicators. The data from each census are published in a series of printed thematic and county volumes. Additionally, CSO supplies more detailed information on a digital dataset, which is generally referred to as Small Area Population Statistics (SAPS).

SAPS breaks the national census data down by various geographic levels and cover the following themes.

- Sex, age and marital status
- Migration, ethnicity and religion
- Irish language
- Families
- Private households
- Housing
- Communal establishments
- Economic status
- Social class
- Socio-economic group
- Education
- Commuting
- Disability, carers and voluntary work
- Occupations
- Industries
- Car and PC ownership

Though the data from the censuses starting from 1981 is electronically available, it is not standardised and hard to join for spatiotemporal analysis. For example identification codes and names of EDs are not the same over this time series. There is not any linking code between SAPS datasets and boundary maps provided by CSO. The data for 1981, 1986 and 1991 censuses are provided as comma delimited or not delimited files. From 1996, census data were provided in a user-friendly browser “Beyond 20/20”, available in CSO website. Recently, CSO launched their upgraded data sharing system “StatBank”; and 2011 census preliminary results are already available there.

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport ☒
	Education	☒	Business	☐	Social	☒	Infrastructure ☐
	Employment	☒	Finance	☐			
Scale[1]:	Coordinates	☐	ED	▣	NUTS3	☒	Province ▣
	Address	☐	County / LA	▣	NUTS2	☒	State ▣
	Towns	☒					

Year(s): 1981-2006 (census years)

Availability: 2002 and 2006 data is available from the CSO website; 1981-2002 data are available from ISSDA.

Links: http://www.cso.ie/en/census

[1] ▣ - available from the source; ☒ - can be generated from the source scale relatively easily. E.g. if data is provided on ED level, it can be aggregated to county or NUTS level.

Place of Work Sample of Anonymised Records (POWSAR)

POWSAR is a 15% anonymised sample of persons at work covering demographic and socio-economic variables which has been implemented as part of Census 2002. The sample includes only persons who at the time of the census were enumerated in a private household or at home, were 15 years old or over and indicated that their present principal status was working for payment or profit.

POWSAR includes information on respondents including the following variables relevant to this report:

- Places of residence and work
- Household composition
- Year the accommodation was built
- Accommodation occupancy nature
- Occupancy
- Number of cars in the household
- Mode of travel
- Departure time
- Journey distance and duration
- Socio-economic group
- Industrial group
- Hours worked last week

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport	☒
	Education	☒	Business	☐	Social	☒	Infrastructure	☐
	Employment	☒	Finance	☐				
Scale:	Coordinates	☐	ED	▣	NUTS3	☒	Province	☒
	Address	☐	County / LA	▣	NUTS2	☒	State	☒
	Towns	▣						

Year(s): 2002

Availability: ISSDA may authorise users who are bona fide students, staff or research personnel to have access to the POWSAR data for the purposes of research. Use of the data and/or any results obtained from use of the data for any other purposes is prohibited without the express permission of the CSO.

Link: http://www.cso.ie/census/POW_2002.htm

Place of Work Census of Anonymised Records (POWCAR)

As part of the Census 2006 processing programme the place of work details of all employed persons who undertook a journey to work were geo-coded. A detailed file containing the demographic and socio-economic characteristics (some of which are indicated for POWSAR above) of these workers along with information on the origin and destination of their journeys to work has been made available for analysis.

Similar to POWSAR, POWCAR records only cover persons who at the time of the census were enumerated in a private household or at home, were 15 years old or over and indicated that their present principal status was working for payment or profit.

In 2002 a POWSAR record was released covering a 15% random sample of persons satisfying the above criteria. In 2006 all records falling within the scope were coded to place of work. The employer address was matched against addresses on the An Post GeoDirectory (see below). Where the coder could not find an exact match they coded to a near match if they could find a GeoDirectory address on the same street or in the same town as the address stated on the form. The Irish National Grids matched from the GeoDirectory were linked back to the place of work ED and Town by superimposing the digital boundaries of the ED, Towns and 2006 Enumeration Areas in the case of the five cities Dublin, Cork, Limerick, Galway and Waterford and their suburbs. The position of place of work destination coded has been rounded to the centre of the 250m x 250m grid square in which the place of work is located.

The variables included in the dataset are similar to the list provided above for POWSAR. Additionally POWCAR also includes accommodation by types (Appendix C).

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport ☒
	Education	☒	Business	☐	Social	☒	Infrastructure ☐
	Employment	☒	Finance	☐			
Scale:	Coordinates	▣	ED	▣	NUTS3	☒	Province ☒
	Address	☐	County / LA	▣	NUTS2	☒	State ☒
	Towns	▣					

Year(s): 2006[1]

Availability: The POWCAR is only available under strict conditions to bone fide researchers who are approved by CSO. All material published from the POWCAR must be approved in advance by CSO.

Link: http://www.cso.ie/census/POWCAR_2006.htm

Census of Population Sample of Anonymised Records (COPSAR)

COPSAR is a 5% anonymised sample of the population covering demographic and socio-economic variables available for the 1996, 2002 and 2006 censuses. Particularly, the following variables relevant to the scope of this report are included in the dataset:

- County of residence
- Age full time education ceased
- Employment Status
- ILO Hours Worked
- ILO Economic Status
- Industry Class
- Occupation Group
- Highest Level of Education
- Third Level Qualifications
- Nationality
- Year of taking up residence RoI
- Present Status
- Place of Birth
- Country of Previous Residence
- Socio-Economic Group
- Social Class

A 5% random sample of the recoded person records from each county was selected in the sample. Though census data were collected at the level of street / townland within ED, only county level data were made available in this sample. The questionnaire was enhanced on time, so there are some modifications and more variables in 2002 and subsequently in 2006.

Theme:	Demography	☒	Economy	☒	Housing	☐	Transport ☐
	Education	☒	Business	☐	Social	☒	Infrastructure ☐
	Employment	☒	Finance	☐			
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province ☒
	Address	☐	County / LA	▣	NUTS2	☒	State ☒
	Towns	☐					

Year(s): 1996, 2002 and 2006

Availability: ISSDA may authorise users who are bona fide students, staff or research personnel to have access to the data for the purposes of research. Use of the data and/or any results obtained from use of the data for any other purposes is prohibited without the express permission of the CSO.

Link: http://www.cso.ie/en/census/samplesofanonymisedrecords/2006censussampleofanonymisedrecordssars

[1] POWCAR from 2011 census will be available later in 2012.

Live Register (LR)

The Live Register figures are published by the CSO at the start of every month and are acquired by collating information from returns made directly to the CSO by each of the local offices of the Department of Social Protection.

The Live register figures include part-time workers (those who work up to three days a week), seasonal and casual workers entitled to Jobseekers Benefit or Allowance (excluding systematic short-time workers & smallholders/farm assists and self-employed persons). The register includes information on the sex, age group, nationality, last held occupation, etc,

The dataset is available from CSO StatBank by Social Welfare office, NUTS3 Region or Province (see more under Department of Social Protection in Appendix A).

Theme:	Demography	☒	Economy	☐	Housing	☐	Transport	☐
	Education	☐	Business	☐	Social	☒	Infrastructure	☐
	Employment	☒	Finance	☐				
Scale:	Coordinates	☐	ED	☐	NUTS3	▣	Province	▣
	Address	☐	County / LA	☐	NUTS2	☒	State	☒
	Towns	☐						

Year(s): 1978-2011 (monthly)

Availability: CSO StatBank

Link:

http://www.cso.ie/px/pxeirestat/Database/eirestat/Live%20Register/Live%20Register_statbank.asp?sp=Live%20Register&Planguage=0

Redundancy

Redundancy generally occurs where somebody loses their job due to circumstances such as the closure of the business or a reduction in the number of staff. The reason could be the financial position of the firm, lack of work, reorganisation within the firm or it may be closing down completely. All redundancy payment and rebate claims are made by employees and employers to the Redundancy Payments Section of the Department of Social Protection (DSP).

The DSP reports monthly statistics on redundancies in Ireland since 1995. The statistics ar available by employment sector, sex or geographic area (county scale and Dublin postal districts). Employment sectors include Agriculture/Forestry and Fisheries; Energy and Water; Extraction Industry (Chemical Products); Metal Manufacturing and Engineering; Other Manufacturing; Building and Civil Engineering; Distributive Trades; Transport and Communications; Other Services; Banking, Finance and Insurance. However, the statistics for these sectors are provided on national scale only, though it may be possible to obtain county level data by special request.

Theme:	Demography	☐	Economy	☐	Housing	☐	Transport	☐
	Education	☐	Business	☐	Social	☐	Infrastructure	☐
	Employment	☒	Finance	☐				
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province	☒
	Address	☐	County / LA	▣	NUTS2	☒	State	☒
	Towns	☐						

Year(s): 1995-2011 (monthly)

Availability: DSP website and reports.

Link:

http://www.welfare.ie/EN/Schemes/RedundancyandInsolvency/redundancy/RedundancyStats/Pages/Index.aspx

Census of Industrial Production (CIP)

The primary focus of the CIP is the collection of information on enterprises and local units with three or more persons engaged that are wholly or primarily engaged in industrial production, such as manufacturing, mining, quarrying, sewerage, waste management and the supply of electricity, gas, steam and water (CSO, 2009b).

The CIP provides structural data about the industrial sector of the economy. Data are collected on variables such as turnover, purchases, stocks, capital assets, labour costs and nationality of ownership classified by industrial sector, by size category of persons engaged, etc.

The CIP is an annual survey. It was first carried out in 1926 with data available from 1985 onwards. The information collected relates to the year of reference. Normally early estimates are produced for a limited number of characteristics after ten months and the final results are published for the full range of characteristics within eighteen months from the end of the reference period.

The CIP comprises two separate but closely related annual inquiries, namely:

1. The Census of Industrial Enterprises covers those enterprises which are wholly or primarily engaged in industrial production and have three or more persons engaged;
2. The Census of Industrial Local Units covers all industrial local units with three or more persons engaged.

The CIP results are published in aggregate form and are available in a number of different cross tabulations. Data is broken down in the publication by activity (NACE[1] rev 2), by geography (NUTS2 Level), by employment, turnover (Euro) and nationality of ownership. However, in the CSO online StatBank depository, the data can be obtained by local authority level.

Theme:	Demography	☐	Economy	☒	Housing	☐	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☐
	Employment	☒	Finance	☒			
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province ☒
	Address	☐	County / LA	▣	NUTS2	▣	State ☒
	Towns	☐					

Year(s): 1979-2011 (annual)

Availability: CSO StatBank

Link: http://www.cso.ie/en/surveysandmethodology/industry/cenindustrialproduction/index.html

Annual Services Inquiry (ASI)

This survey provides grossed estimates of the principal trading aggregates for all enterprises in the retail, wholesale, transport and storage, accommodation and food, information and communication, real estate, professional, technical administrative and other selected services sectors (NACE Rev.2 sectors G, H, I, J, L, M, N, R and S; see Appendix D). The ASI is an Enterprise survey, where an enterprise is defined as the smallest legally independent unit. Enterprises that traded for at least 6 months of the relevant year are included in the survey. The survey sample consists of the census of enterprises with 20+ employees plus a random sample of the smaller units stratified by activity (NACE Rev.2) and employment size class (CSO, 2009d).

[1] Pan-European classification system which groups organisations according to their business activities.

The ASI is an annual survey with the size of 20,000. It is conducted as a postal inquiry. Since 1995 the CSO's Central Business Register provides the sampling frame, from which the ASI sample is selected each year. The following principal variables are collected: turnover, stocks, capital assets, personnel costs, vat, purchases, employment, location, exports, and imports.

Principal external users are National Accounts, Eurostat, Government, Economists, Business consultants, Researchers.

The data is provided by NUTS2 regions.

Theme:	Demography	☐	Economy	☒	Housing	☐	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☐
	Employment	☒	Finance	☒			
Scale:	Coordinates	☐	ED	☐	NUTS3	☐	Province ☐
	Address	☐	County / LA	☐	NUTS2	▣	State ☒
	Towns	☐					

Year(s): 1999-2010

Availability: CSO StatBank

Link: http://www.cso.ie/en/surveysandmethodology/services/annualservicesinquiryforms/annualservicesinquiry

Census of Building and Construction Survey (CBCS)

This is an annual census of building and construction survey including the Allied Trades. It is aimed at medium and large firms and provides information on the structure of the sector.

The annual census is intended to cover firms in the private (i.e. non-State) sector with 20 or more persons engaged whose main activity is building, construction or civil engineering i.e. firms classified to division 45 (Construction) of the NACE Industrial Classification of Economic Activity in the European communities (NACE Rev 1).

The Census of Building and Construction first appeared as a separate census in 1966. Prior to that, data on the building and construction sector was collected and published in the Irish Statistical Bulletin / Irish Trade Journal as part of the Census of Industrial Production (first inclusion in the 1926 Census). It was first published as a separate release document in 1981. Data since 1981 is available electronically on CSO website via Database Direct.

A total of 1553 statutory Census of Building and Construction 2006 forms were issued in April 2007. Completed forms were eventually received from 768 enterprises (59%), covering 66% of employment.

The following variables are included in the census form: Principal Type of Work, Changes in Capital Assets, Stocks and Work in Progress, Purchases of Materials, Fuels and Electricity, Payments to Subcontractors, Cost of Other Goods and Services, Turnover, Indirect Taxes, Employment and Gross Earnings, Other Labour Cost, etc.

The census data is provided on state level only, making it not usable for spatial analysis.

Theme:	Demography	☐	Economy	☒	Housing	☐	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☐
	Employment	☒	Finance	☒			
Scale:	Coordinates	☐	ED	☐	NUTS3	☐	Province ☐
	Address	☐	County / LA	☐	NUTS2	☐	State ▣
	Towns	☐					

Year(s): 1981-2010 (annual)

Availability: CSO StatBank

Link: http://www.cso.ie/en/surveysandmethodology/construction/censusofbuildingandconstruction/index.html

Business Demography (BD)

The data for the Business Demography is based on the CSO Central Business Register. The Business Register is a register of all enterprises that are active in the State. There is no lower size limit, but for practical reasons, BD data is based on enterprises that are registered with the Revenue Commissioners.

The CSO conducts monthly, quarterly and annual surveys covering all sectors of the economy. Other than the annual CIP and the annual Census of Building and Construction, these business surveys are conducted on a sample basis to minimise the statistical reporting burden on the business sector. Particular efforts are made to minimise the data demands on small and medium sized enterprises (SMEs). However, it is regarded as essential that SMEs are represented at an appropriate level in CSO inquiries to ensure that their major contribution to the growth of the economy is monitored and reflected in the national statistics. Newly established businesses and a rotating proportion of existing enterprises are covered in on-going special inquiries to ensure that the basic data (e.g. name, address, legal status, number of persons engaged) held on the CSO Business Register is up-to-date so that representative samples are selected.

BD statistics provide a detailed breakdown of the numbers of active enterprises and newly birthed enterprises in the business economy, covering NACE Rev 2 fourteen sectors B - N (excludes NACE code 64.20 Activities of holding companies), broken down by economic activity and employment class or legal form (Appendix D). Related employment data is also supplied. A breakdown of active enterprises and related employment on a county basis is also provided.

Theme:	Demography	☐	Economy	☐	Housing	☐	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☐
	Employment	☒	Finance	☐			
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province ☒
	Address	☐	County / LA	▣	NUTS2	☒	State ☒
	Towns	☐					

Year(s): 2006-2009

Availability: CSO StatBank

Link: http://www.cso.ie/en/newsandevents/pressreleases/2011pressreleases/businessdemography2009/index.html

Household Budget Survey (HBS)

HBS is a survey of a representative random sample of all private households in RoI. The main purpose of the survey is to determine in detail the current pattern of household income and expenditure in order to update the weighting basis of the Consumer Price Index. Detailed information is also collected on all sources of household income and on a range of household facilities (CSO, 2007). Surveys have been carried out periodically in Ireland since 1951. These data are collated and analysed every 5 years. Data for 2009/2010 has an expected release data of Q2 2012. These data while too coarse for detailed spatial analysis can be utilised to express household spending patterns regionally and related to quality of living within and outside the Dublin Region.

In the 2004-2005 survey, 6,884 households participated in the HBS. This represented a response rate of just over 47%, a decrease of 8% points from the rate achieved in the 1999-2000 HBS. This reflects the increasing difficulty in achieving a high response for an intense survey such as the HBS. As in previous surveys, the results have been re-weighted to reduce the impact of any biases due to differential non-response between different categories of

households. The 2004-2005 HBS also continued the practice, which commenced with the 1987 survey, of integrating into the survey farm households participating in the National Farm Survey conducted by Teagasc.

The following main variables are collected:

- Principal Economic Status
- Occupation
- Industry
- Household Composition
- Social class and Economic Groups
- Farm Acreage
- Town Size and Regional Authority
- Accommodation type
- Household Tenure
- Income and Expenditure

Regarding geographic location, there are variables indicating if the household located in urban or rural areas, as well as if it is in Dublin metropolitan area or in 'other town' categorised by population size. The 2004/05 dataset also includes NUTS2 region. However, it is too coarse for any proper spatial analysis.

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport	☐
	Education	☒	Business	☐	Social	☒	Infrastructure	☐
	Employment	☒	Finance	☒				
Scale:	Coordinates	☐	ED	☐	NUTS3	☐	Province	☐
	Address	☐	County / LA	☐	NUTS2	▣	State	☒
	Towns	☐						

Year(s): 1987**,** 1994**,** 1999/2000 and 2004/05 (with 5 year periodicity at present)

Availability: ISSDA

Links: http://www.cso.ie/en/surveysandmethodology/housingandhouseholds/householdbudgetsurvey

Quarterly National Household Survey / Labour Force Survey (QNHS / LFS)

The QNHS is a large-scale, nationwide survey of households in RoI. It is designed to produce quarterly labour force estimates that include the official measure of employment and unemployment in the state. It is the official source for the production of quarterly labour force estimates (microdata) in Ireland, and meets the requirements of European Council Regulation (EC) No. 577/98, adopted in March 1998.

The survey began in September 1997, replacing the annual April Labour Force Survey (LFS). The QNHS was conducted on a seasonal quarter basis when first introduced in Q4 1997. As of Q1 2009 the QNHS is now conducted on a calendar quarterly basis. Calendar quarter data for 1998 to 2008 inclusive has been rebuilt from the original data collected for the seasonal quarters. The reference quarters for survey results are now calendar based and are: January to March (Q1), April to June (Q2), July to September (Q3) and October to December (Q4).

Information is collected continuously throughout the year, with 39,000 households in each quarter. It should be noted that the data may be subject to sampling error and future revision. The survey collects information including variables from demographic, education, employment and dwelling unit main themes. Therefore the sample is too small to use at an ED level. The CSO also do not release the QHNS at Council level in Dublin but only at a Dublin regional level. Considering the population of each of the Dublin Local Authorities it is surprising for example that the QHNS provides some rural counties with small populations with county figures and not Dublin City Council.

QNHS is a valuable dataset, as it is rare to have such detailed survey data covering almost 15 years. The region of the dwelling unit – coded to NUTS3 detail however, data included in the

associated datasets in the ISSDA are issued at a NUTS2 basis only. Both levels are , coarse for implementing any serious GIS analysis.

The survey data are available for 1988-2011; however the questionnaires were amended and updated over time and the list of variables varies for different years.

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport	☐
	Education	☒	Business	☐	Social	☒	Infrastructure	☐
	Employment	☒	Finance	☐				
Scale:	Coordinates	☐	ED	☐	NUTS3	▣	Province	☐
	Address	☐	County / LA	☐	NUTS2	☒	State	☒
	Towns	☐						

Year(s): 1988-1997 (LFS), 1997-2011 (QNHS)

Availability: The CSO make anonymised microdata files relating to the core QNHS data and selected ad-hoc social modules available free of charge to students and researchers for non-commercial purposes through the ISSDA. LFS data for 1988-1997 is freely available in CSO website.

Link: http://www.cso.ie/en/qnhs

National Travel Survey (NTS)

The NTS was a pilot module conducted in the fourth quarter of the 2009 QNHS. It was commissioned and part funded by the Department of Transport, Tourism and Sport.

The NTS surveyed one randomly selected person, aged 18 years and over, from each household across waves three and five of the QNHS sample. Prior to their travel reference day, each selected person was issued with a travel diary to record their travel details. After the travel reference day, these individuals were contacted by QNHS interviewers and either interviewed in person or by telephone to complete the survey questionnaire. Respondents used their 'travel diary' to aid recall of their travel details (CSO, 2011).

The NTS is one of the most comprehensive household studies of travel patterns and transport demand ever to be conducted within the State. Information on access to and use of public transport, cars and other vehicles was collected from 7,245 households nationwide. Detailed information on travel was then collected from one randomly selected individual from each of these households. In total, 7,221 adults provided information on travel.

The NTS was designed to collect both household and individual level information. The household level information covered the availability of local buses, mainline trains, Dart and Luas services, together with information on bicycle ownership. The individual level information on the questionnaire covered bicycle usage, the ownership and usage of vehicles and vehicle parking at home and at work. Each individual was also asked to provide detailed information on all journeys made during their travel reference day. The information sought included the journey origin and destination, departure and arrival times, the main reason for undertaking the journey, the number of stages to each journey and the distance travelled, travel time and mode of travel used for each stage of the journey. However, trip origins and destinations are coded by their type (e.g. home, work, school, shop, etc.) and not available by geographic location. Similar to QNHS, the only spatial information the dataset includes is the NUTS3 region.

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport	☒
	Education	☒	Business	☐	Social	☐	Infrastructure	☐
	Employment	☒	Finance	☐				

Scale:							
	Coordinates	☐	ED	☐	NUTS3	▣	Province ☐
	Address	☐	County / LA	☐	NUTS2	☒	State ☒
	Towns	☐					

Year(s): 2009 (once off survey)

Availability: ISSDA

Link: http://www.ucd.ie/issda/data/cso/nationaltravelsurvey

EU-Survey on Income and Living Conditions (SILC)

The SILC in Ireland is a household survey covering a broad range of issues in relation to income and living conditions. It is the official source of data on household and individual income and also provides a number of key national poverty indicators, such as the risk of poverty rate and the consistent poverty rate.

SILC was conducted by the CSO for the first time in 2003 under EU legislation. It is the successor survey to the Living in Ireland dataset also available from ISSDA. The survey is currently being conducted on an annual basis in order to monitor changes in income and living conditions over time. The survey is also carried out in other EU member states allowing comparable statistics to be compiled on a pan-European basis.

The main relevant variables covered in the survey are:

- Number of persons in the household
- Household composition
- Tenure status
- Housing Amenities
- Occupation
- Principal economic status
- Employment type
- Economic status
- Health status
- Education level
- Household income
- Deprivation and other indicators

Though this is a valuable micro-level dataset covering seven subsequent years, as geographic information it includes only NUTS2 region, limiting its value for spatial analysis.

Theme:							
	Demography	☒	Economy	☒	Housing	☒	Transport ☐
	Education	☒	Business	☐	Social	☒	Infrastructure ☐
	Employment	☒	Finance	☒			

Scale:							
	Coordinates	☐	ED	☐	NUTS3	☐	Province ☐
	Address	☐	County / LA	☐	NUTS2	▣	State ☒
	Towns	☐					

Year(s): 2003-2009 (annual)

Availability: CSO, ISSDA.

Link: http://www.cso.ie/eusilc

National Survey of Housing Quality (NSHQ)

The ESRI was commissioned by the Department of the Environment to carry out the Irish NSHQ in 2001-2002. A similar survey has been carried approximately every decade. The purpose of the survey was to record detailed information on the condition of the national housing stock. The completed sample size was over 40,000 households throughout the country, using multi-stage randomised design based on the electoral register. This information provides a database that allows assessment of the condition of the Irish housing stock and the identification of housing-related problems among groups of families and households throughout the country.

Information was collected on:

- the basic type of dwelling, its age and location
- the number of rooms of different types available to the household
- rent and mortgage payments, and other indicators of affordability
- services such as water, sewage, electricity and gas
- main method of heating the dwelling and fuel used
- presence of insulation and other energy-saving measures
- problems with the accommodation and major works carried out in the last five years
- household type and age structure
- economic status of household members
- household income

The information is relevant in the areas of housing policy, land use planning, regional development and energy policy. The large sample size allows detailed tables to be provided to Local Authorities for planning purposes.

The NSHQ is different from the national house condition surveys undertaken in 1981 and 1991 in a number of important respects. Firstly, the earlier surveys were conducted separately by the Local Authorities with the results co-ordinated after the surveys were completed. In contrast, the methodology and procedures for the NSHQ have been completely centralised, ensuring a harmonised set of data across Local Authority areas. Secondly, the earlier surveys were of a technical nature, using the judgements of survey staff regarding the general condition of the accommodation. In the 2001-2002 survey, the residents themselves make judgements regarding the extent and nature of problems with the dwelling. In a large number of areas, the NSHQ provides information that is comparable to that collected in 1981 and 1991, such as on the dwelling structure, number of rooms, dwelling age, number of persons of different ages in the dwelling, housing costs and so on. However, the comparability of the results is not as strong when it comes to judgements as to the extent and nature of problems in the dwelling (Watson and Williams 2003).

Theme:	Demography	☒	Economy	☐	Housing	☒	Transport ☐
	Education	☐	Business	☐	Social	☐	Infrastructure ☐
	Employment	☐	Finance	☒			
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province ☐
	Address	☐	County / LA	■	NUTS2	☒	State ☒
	Towns	☐					

Year(s): 2001-2002

Availability: CSO, ISSDA.

Link: http://www.ucd.ie/issda/data/esri/housingquality

Eurostudent Survey (ES)

The ES is a European-wide survey about the social, economic and living conditions of higher education students in EU states, covering the following topics:

- Demographic profile
- Socio-economic background
- Entry route
- Nationality
- Accommodation
- Income and expenditure
- Employment
- Student mobility
- Daily travel to college
- Health and wellbeing

The first ES was in the year 2000, although the survey has its origins in earlier national surveys such as those undertaken by Deutsches Studentenwerk in Germany as early as 1951, and later the Observatoires de la Vie Etudiante in France.

ES provides vital information regarding student life in Ireland. Data for Eurostudent IV was collected via an Internet based survey of thirty higher education institutions from November 2009 to January 2010 (Harmon and Foubert, 2010). In addition, a postal questionnaire was also used with the aim of increasing participation among part-time students who may not often access their academic email.

For each round of the survey, two reports are produced: the Irish input into the European Report, and a separate Irish Report.

As for spatial component, the dataset includes only county of the students' residence after secondary education as well as current higher education institution which can be mapped using GeoDirectory.

The HEA has made the Irish data only from Round IV of the Eurostudent survey available for secondary analysis. Though, there are detailed reports published with summarised information from previous surveys of 2004 (Darmody et al, 2005), and 2006/2007 (Delaney, 2007). Still, the availability of the datasets of previous years will increase the value of the data allowing more research on changes in student life in Ireland during last 5-6 years.

Theme:	Demography	☒	Economy	☒	Housing	☒	Transport	☒
	Education	☒	Business	☐	Social	☒	Infrastructure	☐
	Employment	☒	Finance	☒				
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province	☒
	Address	☐	County / LA	■	NUTS2	☒	State	☒
	Towns	☐						

Year(s): 2000, 2003/2004, 2006/2007, 2009

Availability: ISSDA

Link: http://www.hea.ie/en/eurostudent

CORINE Land Cover (CLC)

CLC is a digital map of the European environmental landscape intended for use by policy makers as well as others. Based on the interpretation of satellite images, CLC provides comparable maps of land cover for each country for much of Europe including Ireland. This is useful for environmental analysis and comparisons as well as for policy making and assessment. CLC 2006 is the third dataset in a series, the previous datasets corresponding to base years of 1990 and 2000.

CLC maps are available in 100m and 250m resolution for 44 land cover classes, which are presented in the Appendix H.

Theme:	Demography	☐	Economy	☐	Housing	☒	Transport	☐
	Education	☐	Business	☐	Social	☐	Infrastructure	☒
	Employment	☐	Finance	☐				
Scale:	Coordinates	■	ED	☒	NUTS3	☒	Province	☒
	Address	☐	County / LA	☒	NUTS2	☒	State	☒
	Towns	☒						

Year(s): 1990, 2000 and 2006

Availability: The datasets for all three parts of the series plus the GMES soil sealing layer are available free of charge and can be downloaded from the EPA Geoportal.

Link: http://www.epa.ie/downloads/data/corinedata

GeoDirectory

GeoDirectory is the definitive address database of buildings in the RoI. It was established by An Post and OSi to identify the precise address and location of every residential and commercial property in the State. The ultimate Irish address database, GeoDirectory assigns each property its own individual fingerprint – a unique, verified address in a standardised format, together with a precise geocode. GeoDirectory gives:

- A distinct, verified address ID for every property – 1.87 million in total
- An exact geographical location – a geocode – for every building
- 196,000 individual business addresses
- A quarterly update which incorporates all changes
- Details of new construction underway.

GeoDirectory includes classification of the organisations by their NACE[1] code (Appendix E) as well as buildings by their type (Appendix F). These classifications have significant value and can be used in cluster analysis (see section 3.2). However, NACE codes were introduced to GeoDirectory only in 2008, and not available in the previous versions.

GeoDirectory updates are released four times a year with each customer receiving a completely refreshed supply of the area they ordered. Each record is time stamped when any field on the record is updated.

Theme:	Demography	☐	Economy	☐	Housing	☒	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☒
	Employment	☐	Finance	☐			
Scale:	Coordinates	▣	ED	▣	NUTS3	☒	Province ☒
	Address	▣	County / LA	▣	NUTS2	☒	State ☒
	Towns	▣					

Year(s): 2003-2011

Availability: It is a commercial product and depending on the requirements the prices can range from €225 - €55,000 for the largest projects.

Link: http://www.geodirectory.ie

FAME

The FAME database contains comprehensive information on over seven million companies in the UK and Ireland covering:

- Company financials with up to 10 years of history and strength indicators
- Contacts, corporate structures and the corporate family
- Original filings/images as filed at Companies House and the Companies Registration Office in Ireland
- Stock data for listed companies
- Shareholders and subsidiaries
- Market research and adverse filings

[1] Pan-European classification system which groups organisations according to their business activities.

- Business and company-related news
- M&A deals and rumours.

There are 180,236 active and 81,201 inactive companies from RoI available in the FAME dataset (according to the update on 02/12/2011). Company activity sectors are classified by 19 major classes (Table 2-6) as well as by NACE Rev2 classification scheme. The web-based user-friendly system also allows implementing different statistical analysis and generating graphs, tables and reports. The list of records can be filtered and extracted by region, county and city.

Compared with GeoDirectory, FAME includes valuable financial information in addition to the addresses. However, each company in FAME is represented as a single record even if it has several branches in different geographic locations. This represents an expected challenge with most of the business datasets. Usually the address of the main branch or headquarter is presented in the FAME database, while all other information covers whole company including all branches. This address information is not geocoded or linked to the GeoDirectory and requires further development for use in this study.

Even if it is joined with GeoDirectory where each branch of a company represented as a separate record, it will be hard to distribute company's general information between them. This limits the potential of FAME dataset in geo-spatial analysis.

Theme:	Demography	☐	Economy	☒	Housing	☐	Transport ☐
	Education	☐	Business	☒	Social	☐	Infrastructure ☐
	Employment	☒	Finance	☒			
Scale:	Coordinates	☐	ED	☐	NUTS3	☒	Province ☒
	Address	■	County / LA	☒	NUTS2	☒	State ■
	Towns	☒					

Year(s): 2011

Availability: It is a commercial database and annual subscription is available from Bv. A Free trial is available.UCD library has access to the top 10,000 companies in Ireland.

Link: http://www.bvdinfo.com/Products/Company-Information/National/FAME.aspx

Other Business Directories

Apart from the FAME, there are a few other commercial business directories such as KOMPASS[1] (Data Ireland), Golden Pages[2], providing a list of companies in Ireland. In these directories usually businesses are searchable by location, sector, product type or contact. It is worth to highlight the KOMPASS, which is a comprehensive Business-2-Business database, with more than 3 million international and domestic companies listed, which link buyers and sellers worldwide. However, like in the case of the FAME database, locational information is provided by address only, and requires matching with GeoDirectory for GIS analysis. An exception is the Golden Pages, which also provides the map of businesses using Microsoft Bing mapping service[3]. Nevertheless, Golden Pages database with companies' geographic coordinates are not available to the public or researchers.

[1] http://www.kompass.ie, http://www.dataireland.ie , http://www.business.ie
[2] http://www.goldenpages.ie
[3] http://maps.goldenpages.ie

C. POWCAR Accommodation Types

ID	Type
1	Detached house
2	Semi-detached house
3	Terraced house
4	Flat/apartment in a purpose-built block
5	Flat/apartment in a converted house or commercial building
6	Bed-sit
7	Caravan or mobile/temporary structure
*	Not stated

D. NACE Rev. 2 Sections (Eurostat, 2008)

Section		Divisions
A	Agriculture, forestry and fishing	01 - 03
B	Mining and quarrying	05 - 09
C	Manufacturing	10 - 33
D	Electricity, gas, steam and air conditioning supply	35
E	Water supply; sewerage, waste management and remediation activities	36 - 39
F	Construction	41 - 43
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	45 - 47
H	Transportation and storage	49 - 53
I	Accommodation and food service activities	55 - 56
J	Information and communication	58 - 63
K	Financial and insurance activities	64 - 66
L	Real estate activities	68
M	Professional, scientific and technical activities	69 - 75
N	Administrative and support service activities	77 - 82
O	Public administration and defence; compulsory social security	84
P	Education	85
Q	Human health and social work activities	86 - 88
R	Arts, entertainment and recreation	90 - 93
S	Other service activities	94 - 96
T	Activities of households as employers; undifferentiated goods-and services-producing; Activities of households for own use	97 - 98
U	Activities of extraterritorial organisations and bodies	99

E. Organisation Categories in GeoDirectory 2011

NACE Code	Category	ID
A	**Agriculture, forestry and fishing**	
A.01.00	Crop and animal production, hunting and related service activities	11
A.01.13	Growing of vegetables and melons, roots and tubers	863
A.01.19	Growing of other non-perennial crops	1163
A.01.20	Growing of perennial crops	624
A.01.25	Growing of other tree and bush fruits and nuts	561
A.01.30	Plant propagation	502
A.01.41	Raising of dairy cattle	302
A.01.43	Raising of horses and other equines	321
A.01.46	Raising of swine/pigs	241
A.01.47	Raising of poultry	365
A.01.49	Raising of other animals	183
A.01.61	Support activities for crop production	367
A.01.62	Supporting activities for animal production	601
A.02.00	Forestry and logging	40
A.02.40	Support services to forestry	459
A.03.00	Fishing and aquaculture	38
A.03.10	Fishing	504
A.03.11	Marine fishing	663
A.03.21	Marine aquaculture	947
B	**Mining and quarrying**	
B.08.12	Operation of gravel and sand pits; mining of clays and kaolin	764
B.08.90	Mining and quarrying	71
C	**Manufacturing**	
C.10.00	Manufacture of food products	167
C.10.11	Processing and preserving of meat	181
C.10.13	Production of meat and poultry meat products	447
C.10.20	Processing and preserving of fish, crustaceans and molluscs	449
C.10.51	Operation of dairies and cheese making	445
C.10.89	Manufacture of other food products n.e.c.	803
C.10.91	Manufacture of prepared feeds for farm animals	421
C.11.00	Manufacture of beverages	322
C.11.07	Manufacture of soft drinks; production of mineral waters & other bottled waters	1025
C.13.99	Manufacture of other textiles n.e.c.	905
C.14.00	Manufacturing of wearing apparel	701
C.16.10	Sawmilling and planning of wood	281
C.16.29	Manufacture of other products of wood: manufacture of articles of cork, straw and plaiting materials	443
C.18.10	Printing and service activities related to printing	101
C.18.11	Printing of newspapers	100
C.18.12	Other printing	95
C.20.20	Manufacture of pesticides and other agro-chemical products	66
C.20.59	Manufacture of other chemical products n.e.c.	682
C.21.10	Manufacture of basic pharmaceutical products	67

NACE Code	Category	ID
C.22.23	Manufacture of builders' ware of plastic	1103
C.23.11	Manufacture of glass and glass products	945
C.23.61	Manufacture of concrete products for construction purposes	166
C.23.70	Cutting, shaping and finishing of stone	410
C.24.10	Manufacture of basic iron and steel and of ferro-alloys	623
C.25.00	Manufacture of fabricated metal products, except machinery and equipment	182
C.25.12	Manufacture of doors and windows of metal	1104
C.25.29	Manufacture of other tanks, reservoirs and containers of metal	386
C.25.62	Machining	413
C.27.40	Manufacture of electric lighting equipment	1063
C.28.00	Manufacture of machinery and equipment	282
C.28.25	Manufacture of non-domestic cooling and ventilation equipment	446
C.30.12	Building of pleasure and sporting boats	745
C.30.91	Manufacture of motorcycles	323
C.30.92	Manufacture of bicycles and invalid carriages	65
C.31.00	Manufacture of furniture	64
C.31.02	Manufacture of kitchen furniture	441
C.31.09	Manufacture of other furniture	1083
C.32.12	Manufacture of jewellery and related articles	946
C.33.12	Repair of machinery	407
C.33.14	Repair of electrical equipment	442
C.33.15	Repair and maintenance of ships and boats	948
D	**Electricity, gas, steam and air conditioning supply**	
D.35.10	Electric power generation, transmission and distribution	96
E	**Water supply, sewerage, waste management and remediation activities**	
E.36.00	Water collection, treatment and supply	19
E.37.00	Sewerage	137
E.38.11	Collection of non-hazardous waste	460
E.38.21	Treatment and disposal of non-hazardous waste	361
E.38.32	Recovery of sorted materials	408
F	**Construction**	
F.41.00	Construction of buildings	22
F.41.10	Development of building projects	345
F.41.20	Construction of residential and non-residential buildings	963
F.42.11	Construction of roads and motorways	377
F.42.21	Construction of utility projects for fluids	451
F.43.21	Electrical installation	329
F.43.22	Plumbing, heat and air conditioning installation	91
F.43.29	Other construction installation	481
F.43.31	Plastering	1144
F.43.32	Joinery installation	301
F.43.33	Floor and wall covering	370
F.43.34	Painting and glazing	88
F.43.39	Other building completion and finishing	76
F.43.91	Roofing activities	1143

NACE Code	Category	ID
F.43.99	Other specialised construction activities	346
G	**Wholesale and retail trade; repair of motor vehicles and motorcycles**	
G.45.10	Sale of motor vehicles	133
G.45.19	Sale of other motor vehicles	923
G.45.20	Maintenance and repair of motor vehicles	163
G.45.30	Sale of motor vehicle parts and accessories	261
G.45.32	Retail trade of motor vehicle parts and accessories	452
G.45.40	Sale, maintenance and repair of motorcycles and related parts and accessories	541
G.46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	454
G.46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	422
G.46.23	Wholesale of live animals	1023
G.46.31	Wholesale of fruit and vegetables	864
G.46.32	Wholesale of meat and meat products	403
G.46.33	Wholesale of dairy products, eggs and edible oils and fats	482
G.46.34	Wholesale of beverages	457
G.46.36	Wholesale of sugar and chocolate and sugar confectionery	501
G.46.38	Wholesale of other food, including fish, crustaceans and mollusce	444
G.46.39	Non-specialised wholesale of food, beverages and tobacco	371
G.46.43	Wholesale of electrical household appliances	385
G.46.47	Wholesale of furniture, carpets and lighting equipment	1064
G.46.61	Wholesale of agricultural machinery, equipment and supplies	146
G.46.71	Wholesale of solid, liquid and gaseous fuels and related products	681
G.46.73	Wholesale of wood, construction materials and sanitary equipment	406
G.46.74	Wholesale of hardware, plumbing and heating equipment and supplies	1123
G.46.77	Wholesale of waste and scrap	401
G.47.00	Retail trade, except of motor vehicles and motorcycles	132
G.47.11	Retail sale in non-specialized stores with food, beverages or tobacco predominating	114
G.47.19	Other retail sale in non-specialised stores	505
G.47.20	Retail sale of food, beverages and tobacco in specialised stores	123
G.47.21	Retail sale of fruit and vegetables in specialised stores	125
G.47.22	Retail sale of meat and meat products in specialised stores	128
G.47.23	Retail sale of fish, crustaceans and molluscs in specialised stores	122
G.47.24	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialised stores	118
G.47.25	Retail sale of beverages in specialised stores	115
G.47.29	Other retail sale of food in specialised stores	375
G.47.30	Retail sale of automotive fuel in specialised stores	116
G.47.41	Retail sale of computers, peripheral units and software in specialised stores	387
G.47.42	Retail sale of telecommunications equipment in specialised stores	351
G.47.51	Retail sale of textiles in specialised stores	130
G.47.52	Retail sale of hardware, paints and glass in specialised stores	127
G.47.53	Retail sale of carpets, rugs, wall and floor coverings in specialised stores	373
G.47.54	Retail sale of electrical household appliances in specialised stores	121

NACE Code	Category	ID
G.47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores	126
G.47.61	Retail sale of books in specialised stores	324
G.47.62	Retail sale of newspapers and stationery in specialised stores	117
G.47.63	Retail sale of music and video recordings in specialised stores	364
G.47.64	Retail sale of sporting equipment in specialised stores	409
G.47.65	Retail sale of games and toys in specialised stores	368
G.47.70	Retail sale of other goods in specialised stores	161
G.47.71	Retail sale of clothing in specialised stores	119
G.47.72	Retail sale of footwear and leather goods in specialised stores	124
G.47.73	Dispensing chemist in specialised stores	29
G.47.74	Retail sale of medical and orthopaedic goods in specialised stores	129
G.47.75	Retail sale of cosmetic and toilet articles in specialised stores	120
G.47.76	Retail sale of flowers, plants, seeds, fertilisers, pet animals and pet food in specialised stores	356
G.47.77	Retail sale of watches and jewellery in specialised stores	363
G.47.78	Other retail sale of new goods in specialised stores	168
G.47.79	Retail sale of second-hand goods in stores	348
G.47.80	Retail sale via stalls and markets	1105
G.47.91	Retail sale via mail order houses or via internet	131
G.47.99	Other retail sale not in stores, stalls or markets	783
H	**Transportation and storage**	
H.49.00	Land transport and transport via pipelines	57
H.49.20	Freight rail transport	142
H.49.32	Taxi operation	140
H.49.39	Other passenger land transport n.e.c.	581
H.49.41	Freight transport by road	41
H.50.10	Sea and coastal passenger water transport	1283
H.50.20	Sea and coastal freight water transport	503
H.51.00	Air transport	12
H.51.10	Passenger air transport	1345
H.51.21	Freight air transport	1346
H.52.10	Warehousing and storage	162
H.52.21	Service activities incidental to land transportation	384
H.52.22	Service activities incidental to water transportation	906
H.52.23	Service activities incidental to air transportation	1344
H.52.29	Other transportation support activities	741
H.53.00	Post and courier activities	93
H.53.10	Postal activities under universal service obligation	326
H.53.20	Other postal and courier activities	74
I	**Accommodation and food service activities**	
I.55.00	Accommodation	53
I.55.10	Hotels and similar accommodation	51
I.55.20	Holiday and other short-stay accommodation	380
I.55.30	Camping grounds, recreational vehicle parks and trailer parks	17
I.55.90	Other accommodation	84

NACE Code	Category	ID
I.56.00	Food and beverage service activities	113
I.56.10	Restaurants and mobile food service activities	325
I.56.21	Event catering activities	18
I.56.29	Other food service activities	330
I.56.30	Beverage serving activities	14
J	**Information and communication**	
J.58.10	Publishing of books, periodicals and other publishing activities	1084
J.58.20	Software publishing	378
J.59.11	Motion picture, video and television programme production activities	165
J.59.13	Motion picture, video and television programme distribution activities	1164
J.59.14	Motion picture projection activities	73
J.59.20	Sound recording and music publishing activities	379
J.60.10	Radio broadcasting	102
J.60.20	Television programming and broadcasting activities	328
J.61.00	Telecommunications	621
J.61.10	Wired telecommunications activities	355
J.61.90	Other telecommunications activities	622
J.62.00	Computer programming, consultancy and related activities	20
J.62.01	Computer programming activities	1323
J.62.02	Computer consultancy activities	46
J.62.09	Other information technology and computer related activities	80
J.63.10	Data processing, hosting and related activities; web portals	24
J.63.11	Data processing, hosting and related activities	763
J.63.12	Web portals	25
J.63.91	News agency activities	75
J.63.99	Other information service activities	347
K	**Financial and insurance activities**	
K.64.00	Financial service activities, except insurance and pension funding	35
K.64.19	Other monetary intermediation	341
K.64.20	Activities of holding companies	349
K.64.92	Other credit granting	903
K.65.00	Insurance, reinsurance and pension funding, except compulsory social security	54
K.65.11	Life insurance	1183
K.66.00	Activities auxiliary to financial services and insurance activities	641
K.66.12	Security and commodity contracts brokerage	522
K.66.19	Other activities auxiliary to financial services, except insurance and pension	366
K.66.21	Risk and damage evaluation	943
L	**Real estate activities**	
L.68.00	Real estate activities	107
L.68.20	Renting and operating of own or leased real estate	521
L.68.32	Management of real estate on a fee or contract basis	103
M	**Professional, scientific and technical activities**	
M.69.00	Legal and accounting activities	59
M.69.10	Legal activities	58
M.69.20	Accounting, book-keeping and auditing activities; tax consultancy	1

NACE Code	Category	ID
M.70.21	Public relations and communication activities	1024
M.70.22	Business and other management consultancy activities	15
M.71.10	Architectural and engineering activities and related technical consultancy	13
M.71.11	Architectural activities	1003
M.71.12	Engineering activities and related technical consultancy	742
M.71.20	Technical testing and analysis	661
M.73.10	Advertising	201
M.73.12	Media representation	411
M.73.20	Market research and public opinion polling	69
M.74.10	Specialised design activities	376
M.74.20	Photographic activities	89
M.74.90	Other professional, scientific and technical activities	359
M.75.00	Veterinary activities	144
N	**Administrative and support service activities**	
N.77.10	Renting and leasing of motor vehicles	109
N.77.11	Renting and leasing of cars and light motor vehicles	456
N.77.21	Renting and leasing of recreational and sports goods	983
N.77.22	Renting of video tapes and disks	344
N.77.29	Renting and leasing of other personal and household goods	744
N.77.31	Renting and leasing of agricultural machinery and equipment	1203
N.77.34	Renting and leasing of water transport equipment	743
N.77.35	Renting and leasing of air transport equipment	984
N.77.39	Renting and leasing of other machinery, equipment and tangible goods	358
N.78.10	Activities of employment placement agencies	56
N.79.10	Travel agency and tour operator activities	8
N.79.90	Other reservation service and related activities	542
N.80.20	Security systems service activities	354
N.80.30	Investigation activities	1043
N.81.21	General cleaning of buildings	369
N.81.22	Other building and industrial cleaning activities	823
N.81.29	Other cleaning activities	448
N.81.30	Landscape service activities	357
N.82.10	Office administration and support activities	221
N.82.11	Combined office administrative service activities	388
N.82.20	Activities of call centres	458
N.82.30	Organisation of conventions and trade shows	462
N.82.92	Packaging activities	87
N.82.99	Other business support service activities	78
O	**Public administration and defence; compulsory social security**	
O.84.00	Public administration and defence; compulsory social security	97
O.84.11	General public administration activities	404
O.84.12	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security	662
O.84.21	Foreign affairs	39
O.84.22	Defence activities	26
O.84.23	Justice and judicial activities	55

NACE Code	Category	ID
O.84.24	Public order and safety activities	99
O.84.25	Fire service activities	36
O.84.30	Compulsory social security activities	402
P	**Education**	
P.85.00	Education	32
P.85.10	Pre-primary education	327
P.85.20	Primary education	94
P.85.30	Secondary education	135
P.85.32	Technical and vocational secondary education	141
P.85.42	Tertiary education	49
P.85.51	Sports and recreation education	381
P.85.52	Culture education	412
P.85.53	Driving school activities	30
P.85.59	Other education	9
Q	**Human health and social work activities**	
Q.86.10	Hospital activities	50
Q.86.21	General medical practice activities	70
Q.86.22	Specialist medical practice activities	1303
Q.86.23	Dental practice activities	27
Q.86.90	Other human health activities	83
Q.87.10	Residential nursing care activities	352
Q.87.30	Residential care activities for the elderly and disabled	450
Q.88.00	Social work activities without accommodation	138
Q.88.10	Social work activities without accommodation for the elderly and disabled	1263
Q.88.91	Child day-care activities	362
Q.88.99	Other social work activities without accommodation	382
R	**Arts, entertainment and recreation**	
R.90.00	Creative, arts and entertainment activities	164
R.90.01	Performing arts	1223
R.90.03	Artistic creation	374
R.90.04	Operation of arts facilities	1243
R.91.01	Library and archives activities	61
R.91.02	Museums activities	721
R.91.03	Operation of historical sites and buildings and similar visitor attractions	944
R.91.04	Botanical and zoological gardens and nature reserve activities	461
R.92.00	Gambling and betting activities	43
R.93.00	Sports activities and amusement and recreation activities	108
R.93.11	Operation of sports facilities	360
R.93.12	Activities of sport clubs	343
R.93.13	Fitness facilities	342
R.93.19	Other sports activities	372
R.93.29	Other amusement and recreation activities	455
S	**Other service activities**	
S.94.00	Activities of membership organizations	5
S.94.10	Activities of business , employers and professional membership organisations	169

NACE Code	Category	ID
S.94.20	Activities of trade unions	383
S.94.91	Activities of religious organizations	7
S.94.92	Activities of political organizations	6
S.94.99	Activities of other membership organisations	350
S.95.11	Repair of computers and peripheral equipment	405
S.95.12	Repair of communication equipment	843
S.95.20	Repair of personal and household goods	112
S.95.21	Repair of consumer electronics	924
S.95.22	Repair of household appliances and home and garden equipment	844
S.95.23	Repair of footwear and leather goods	904
S.95.29	Repair of other personal and household goods	453
S.96.01	Washing and (dry-)cleaning of textile and fur products	353
S.96.02	Hairdressing and other beauty treatment	45
S.96.03	Funeral and related activities	42
S.96.04	Physical well-being activities	90
S.96.09	Other personal service activities	86

F. Building Types in GeoDirectory 2011

ID	Name	ID	Name
1	Terrace	222	Mobile home park
2	Industrial estate	241	Sports complex
3	Shopping centre	261	Urban area
21	Apartment complex	282	Townhouses
22	Educational campus	303	Private estate
26	Business park	404	Religious organisation
41	Hospital	423	College
42	Nursing home	443	Power generation plant
61	Vocational training & employment	483	Group of detached
63	Court	503	Shopping complex
66	Halting site	524	Holiday homes
83	Flat complex	525	Commercial-residential
103	Housing estate	584	Hotel complex
121	Sheltered housing	646	Heritage and historical
201	School	663	Factory complex
221	Townland		

H. CORINE Land Cover Classes

GRID CODE	CLC CODE	Label1	Label2	Label3
1	111	Artificial surfaces	Urban fabric	Continuous urban fabric
2	112	Artificial surfaces	Urban fabric	Discontinuous urban fabric
3	121	Artificial surfaces	Industrial, commercial and transport units	Industrial or commercial units
4	122	Artificial surfaces	Industrial, commercial and transport units	Road and rail networks and associated land
5	123	Artificial surfaces	Industrial, commercial and transport units	Port areas
6	124	Artificial surfaces	Industrial, commercial and transport units	Airports
7	131	Artificial surfaces	Mine, dump and construction sites	Mineral extraction sites
8	132	Artificial surfaces	Mine, dump and construction sites	Dump sites
9	133	Artificial surfaces	Mine, dump and construction sites	Construction sites
10	141	Artificial surfaces	Artificial, non-agricultural vegetated areas	Green urban areas
11	142	Artificial surfaces	Artificial, non-agricultural vegetated areas	Sport and leisure facilities
12	211	Agricultural areas	Arable land	Non-irrigated arable land
13	212	Agricultural areas	Arable land	Permanently irrigated land
14	213	Agricultural areas	Arable land	Rice fields
15	221	Agricultural areas	Permanent crops	Vineyards
16	222	Agricultural areas	Permanent crops	Fruit trees and berry plantations
17	223	Agricultural areas	Permanent crops	Olive groves
18	231	Agricultural areas	Pastures	Pastures
19	241	Agricultural areas	Heterogeneous agricultural areas	Annual crops associated with permanent crops
20	242	Agricultural areas	Heterogeneous agricultural areas	Complex cultivation patterns
21	243	Agricultural areas	Heterogeneous agricultural areas	Land principally occupied by agriculture, with significant areas of natural vegetation
22	244	Agricultural areas	Heterogeneous agricultural areas	Agro-forestry areas
23	311	Forest and semi natural areas	Forests	Broad-leaved forest
24	312	Forest and semi natural areas	Forests	Coniferous forest
25	313	Forest and semi natural areas	Forests	Mixed forest
26	321	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Natural grasslands
27	322	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Moors and heathland
28	323	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Sclerophyllous vegetation
29	324	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Transitional woodland-shrub
30	331	Forest and semi natural areas	Open spaces with little or no vegetation	Beaches, dunes, sands
31	332	Forest and semi natural areas	Open spaces with little or no vegetation	Bare rocks
32	333	Forest and semi natural areas	Open spaces with little or no vegetation	Sparsely vegetated areas

33	334	Forest and semi natural areas	Open spaces with little or no vegetation	Burnt areas
34	335	Forest and semi natural areas	Open spaces with little or no vegetation	Glaciers and perpetual snow
35	411	Wetlands	Inland wetlands	Inland marshes
36	412	Wetlands	Inland wetlands	Peat bogs
37	421	Wetlands	Maritime wetlands	Salt marshes
38	422	Wetlands	Maritime wetlands	Salines
39	423	Wetlands	Maritime wetlands	Intertidal flats
40	511	Water bodies	Inland waters	Water courses
41	512	Water bodies	Inland waters	Water bodies
42	521	Water bodies	Marine waters	Coastal lagoons
43	522	Water bodies	Marine waters	Estuaries
44	523	Water bodies	Marine waters	Sea and ocean
48	999	NODATA	NODATA	NODATA
49	990	UNCLASSIFIED	UNCLASSIFIED LAND SURFACE	UNCLASSIFIED LAND SURFACE
50	995	UNCLASSIFIED	UNCLASSIFIED WATER BODIES	UNCLASSIFIED WATER BODIES
255	990	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED

I. Broad level categories of some benchmark studies

Area	Sample Benchmark Studies	Sample Benchmark Studies - references
Macro Economic Performance, Finance & Investment and Competitiveness	Global Metro Monitor, World Economic Forum, Travel and Tourism Competitiveness (national), Ernst&Young European (FDI) Attractiveness Report fDi, Cities of the Future fDi, European Regions of the Future Mastercard Worldwide Centres of Commerce Z/Yen Group Global Financial Centres Index Cushman & Wakefield, European Cities Monitor	Brookings Institution, Global Metro Monitor, Metropolitan Policy Program, The Brookings Institution, London School of Economics and Political Science, London, UK, 2010. http://www.brookings.edu/reports/2010/1130_global_metro_monitor.aspx World Economic Forum, *Global Competitiveness Report*, 2011-2012, Geneva, Switzerland, 2011. http://www.weforum.org/issues/global-competitiveness World Economic Forum, Travel and Tourism Competitiveness Report 2011, Geneva, Switzerland, 2011. http://www.weforum.org/issues/travel-and-tourism-competitiveness Ernst & Young *Restart* -European (FDI) Attractiveness Report, 2011, London, UK http://www.ey.com/GL/en/Issues/Business-environment/2011-European-attractiveness-survey fDi Intelligence (Financial Times), Cities of the Future, 2010/2011, London, UK, 2011 fDi Intelligence (Financial Times), Regions of the Future, 2010/2011, London, UK, 2011 http://www.fdiintelligence.com/Rankings2/European-Cities-Regions-of-the-Future-2010-11 Mastercard Worldwide, Mastercard Worldwide Centres of Commerce, NY, US, 2008 http://www.mastercard.com/us/company/en/insights/pdfs/2008/MCWW_WCoC-Report_2008.pdf MasterCard Index of Global Destination Cities: Cross-Border Travel and Expenditures, NY, US, 2010 http://insights.mastercard.com/white-papers/mastercard-index-of-global-destination-cities-cross-border-travel-and-expenditures/ Z/Yen Group, Global Financial Centres Index, Qatar Financial Centres Authority, 2011 http://www.zyen.com/activities/gfci.html Cushman & Wakefield, European Cities Monitor, https://www.cushwake.com/cwglobal/jsp/kcReportDetail.jsp?Country=GLOBAL&Language=EN&catId=100003&pId=c38200001p
Quality of Living Indices	Mercer Quality of Living, EIU Liveability	Mercer, Quality of Living Worldwide City Rankings –Mercer Survey, London, UK, 2011

Area	Sample Benchmark Studies	Sample Benchmark Studies - references
	Survey, Euro Barometer	http://www.mercer.com/qualityoflivingpr#city-rankings Economist Intelligence Unit (EIU), Global Liveability Report, The Economist, London, UK, 2011 http://www.eiu.com/site_info.asp?info_name=The_Global_Liveability_Report&rf=0 EU, EuroBarometer Survey on Perception of Quality of Life, European Foundation Centre, Brussels, Belgium http://www.efc.be/News/Pages/EurobarometersurveyonhowEuropeancitizensviewqualityoflifeintheircities.aspx http://ec.europa.eu/health/eurobarometers/index_en.htm Mercer, City Mayors, Best Cities in the World, 2011 http://www.citymayors.com/environment/eiu_bestcities.html
Knowledge Economy	QS, University Rankings; MBA, Global Rankings; Huggins, World Knowledge Competitiveness Index (NUTS II);	QS, World University Rankings, QS, 2011 http://www.topuniversities.com/university-rankings/world-university-rankings Financial Times, MBA Global Rankings, London, UK, 2011 http://rankings.ft.com/businessschoolrankings/global-mba-rankings-2011 Huggins, World Knowledge Competitiveness Index, 2007 http://www.hugginsassociates.com/index.php/cPath/22
Environment and Sustainability	Siemens Green City Index; Mercer Eco-City Ranking	EIU, Siemens Green City Index, The Economist, London, UK, 2011. http://www.siemens.com/entry/cc/en/greencityindex.html http://www.codema.ie/news-article/date/2011/09/30/european-green-city-index-for-2011.html Mercer, Quality of Living (Eco-City) Rankings –Mercer Survey, London, UK, 2011 http://www.mercer.com/qualityoflivingpr#city-rankings http://www.mercer.ie/press-releases/1381130
Cost of Living, Affordability	UBS, Prices and Earnings, Mercer, Cost of Living Survey; Globe Shopper Index	UBS Wealth Management Research, Prices and Earnings, UBS, 2011 https://www.ubs.com/global/en/wealth_management/wealth_management_research/prices_earnings.html Mercer, Cost of Living Survey, London, UK, 2011 http://www.mercer.com/articles/1095320

Area	Sample Benchmark Studies	Sample Benchmark Studies - references
		EIU, Globe Shopper Index, The Economist, London, UK, 2011 http://www.globeshopperindex.eiu.com/
Infrastructure and Connectivity	Mercer Top Cities for Infrastructure (2009); Cushman and Wakefield, Office and Industrial Space Across the World GaWC, Globalisation and World Cities Network -Global Network Connectivities; Cisco, Broadband Performance.	Cushman and Wakefield, Office and Industrial Space Across the World, 2011. Cushman and Wakefield, Global Office Space, 2012-2013 http://www.cushwake.com/cwglobal/jsp/kcReportDetail.jsp?Country=GLOBAL&Language=EN&catId=100003&pId=c33900004p GaWC (Globalisation and World Cities), GaWC Research Network, Loughborough University, Leicestershire, UK, 2010. http://www.lboro.ac.uk/gawc/publicat.html http://www.lboro.ac.uk/gawc/world2010.html Saïd Business School, Oxford University, Broadband Quality, 2010, Cisco http://newsroom.cisco.com/dlls/2010/prod_101710.html
Branding and Identity	Euromonitor, International Top City Destinations; Saffron, European Cities Branding	Euromonitor, International Top City Destinations, 2012 http://www.euromonitor.com/ http://blog.euromonitor.com/2012/01/euromonitor-internationals-top-city-destinations-ranking1-.html Saffron, European Cities Branding - 'The **City Brand** Barometer' , 2008 http://www.citymayors.com/marketing/city-brands.html
Culture, Diversity and Tolerance	OECD, Society at a Glance (national); Forbes, Best Cities to Eat Well	OECD, Society at a Glance (national), OECD, 2011 http://www.oecd.org/document/24/0,3343,en_2649_34637_2671576_1_1_1_1,00.html Forbes, Best Cities to Eat Well, 2009 http://www.forbes.com/2009/08/04/culinary-food-wine-lifestyle-food-wine-travel.html