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MASTER OF SCIENCE IN URBAN PLANNING AND POLICY DESIGN

Urban Quality Related Effects on Residential Property Prices in Dublin, Ireland

Thesis By **Michael Diarmuid Culleton**
Student ID **961864**
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Supervisor **Oppio Alessandra**
Co-Supervisor **Marta Dell'Ovo**

ABSTRACT

Urban quality is a multifaceted and integral concept encompassing diverse dimensions of the built environment, amenities, and services. It holds significant implications for residents' quality of life, shaping their preferences regarding residential location choices and ultimately influencing property prices. Therefore, thoroughly comprehending the relationship between urban quality and residential property prices is essential for policymakers, urban planners, developers, and investors seeking to improve urban environments and make informed decisions. This thesis investigates the effects of urban quality on residential property prices in Dublin, Ireland. The city's level of accessibility, the provision of services and social infrastructure and the condition of the public realm contribute to its overall urban quality. An integrated evaluation framework will address this question, combining spatial analysis techniques and econometric modelling. This framework enables the comprehensive assessment of various urban quality-related factors and their influence on residential property prices. The research methodology adopts a two-phase multi-methodological approach. The quantitative analysis entails implementing econometric modelling techniques to estimate the marginal price effects of urban quality indicators on residential properties in Dublin. Supported by a Spatial Multi-Criteria Analysis (SMCA) which was conducted, integrating Geographical Information Systems (GIS) and data related to the spatial elements contributing to urban quality. Through an in-depth examination of the relationship between urban quality and residential property prices, it can be determined that the premium associated with urban quality tends to be minimal in the context of other independent variables analysed as part of this investigation.

Keywords: urban quality, multi-criteria decision analysis, hedonic price model

ABSTRACT IN LINGUA ITALIANA

La qualità urbana è un concetto multiforme e integrale che comprende diverse dimensioni dell'ambiente costruito, delle strutture e dei servizi. Essa ha implicazioni significative per la qualità della vita dei residenti, modellando le loro preferenze in merito alle scelte di ubicazione delle abitazioni e, in ultima analisi, influenzando i prezzi degli immobili. Pertanto, comprendere a fondo la relazione tra la qualità urbana e i prezzi degli immobili residenziali è essenziale per i responsabili politici, i pianificatori urbani, gli sviluppatori e gli investitori che cercano di migliorare gli ambienti urbani e prendere decisioni informate. Questa tesi analizza gli effetti della qualità urbana sui prezzi degli immobili residenziali a Dublino, in Irlanda. Il livello di accessibilità della città, la fornitura di servizi e di infrastrutture sociali e le condizioni dell'ambiente pubblico contribuiscono alla qualità urbana complessiva. Un quadro di valutazione integrato affronterà questa questione, combinando tecniche avanzate di analisi spaziale e modellazione econometrica. Questo quadro consente di valutare in modo completo i vari fattori legati alla qualità urbana e la loro influenza sui prezzi degli immobili residenziali. La metodologia di ricerca adotta un approccio multimetodologico in due fasi. L'analisi quantitativa prevede l'implementazione di tecniche di modellazione econometrica per stimare gli effetti marginali dei prezzi degli indicatori di qualità urbana sugli immobili residenziali a Dublino. L'analisi quantitativa è supportata da un'analisi spaziale multi-criteriale (SMCA), condotta integrando sistemi informativi geografici (GIS) e dati relativi agli elementi spaziali che contribuiscono alla qualità urbana. Attraverso un esame approfondito della relazione tra la qualità urbana e i prezzi degli immobili residenziali, è possibile determinare che il premio associato alla qualità urbana tende a essere minimo nel contesto di altre variabili indipendenti analizzate nell'ambito di questa indagine.

Parole chiave: qualità urbana, analisi decisionale multicriteriale, modello di prezzo edonico

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1 CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Urban quality is a multifaceted and integral concept encompassing diverse dimensions of the built environment, amenities, and services. It holds significant implications for residents' quality of life, shaping their preferences regarding residential location choices and ultimately influencing property prices. Therefore, thoroughly comprehending the relationship between urban quality and residential property prices is essential for policymakers, urban planners, developers, and investors seeking to improve urban environments and make informed decisions.

This thesis investigates the effects of urban quality on residential property prices in Dublin, Ireland. As Ireland's capital city and economic centre, Dublin has undergone significant urbanisation, population growth, and profound transformations in its urban landscape. The city's distinctive spatial configuration, historical heritage, open space provision, amenities availability, and transportation infrastructure collectively contribute to its overall urban quality. Consequently, exploring how these factors influence residential property prices is pivotal in comprehending Dublin's real estate dynamics and urban development patterns.

At the core of this thesis lies the central research question: What is the relationship between urban quality indicators and residential property prices in Dublin? An integrated evaluation framework will address this question, combining advanced spatial analysis techniques and economic modelling. This framework enables the comprehensive assessment of various urban quality-related factors and their influence on residential property prices.

The research methodology adopts a two-phase multi-methodological approach. The quantitative analysis entails implementing econometric modelling techniques to estimate the marginal price effects of urban quality indicators on residential properties in Dublin. Additionally, a Spatial Multiple Criteria Decision Analysis (SMCDA) will be conducted, integrating Geographical Information Systems (GIS) data and decision-makers preferences to assess the spatial elements contributing to urban quality.

Through an in-depth examination of the relationship between urban quality and residential property prices, this research provides valuable insights into Dublin's real estate market dynamics. The findings of this study will contribute to the existing academic knowledge and hold practical implications for policymakers and urban planners in their endeavours to enhance urban quality and create sustainable and liveable communities.

In conclusion, this thesis seeks to advance the understanding of how urban quality influences residential property prices in Dublin. By conducting a comprehensive analysis of spatial and economic factors, the research aims to elucidate the intricate relationship between urban quality indicators and the real estate market, offering significant insights for future urban development strategies and decision-making processes.

1.2 RESEARCH AIMS

The primary aim of this research is to investigate the relationship between urban quality and residential property prices in Dublin, Ireland. In pursuit of this overarching goal, the specific research aims are as follows:

- To identify and evaluate the critical urban quality indicators that influence residential property prices in Dublin.
- To develop a Spatial Multi-Criteria Analysis (SMCA) framework for assessing urban quality in Dublin: This aim involves integrating spatial data provided through Geographical Information Systems (GIS) and decision-maker preferences into value maps. The MCDA framework will enable the evaluation and mapping of urban quality indicators, considering their spatial distribution and relative importance.
- To construct an econometric model to estimate the price effects of urban quality on residential property prices.
- To provide insights and recommendations for urban planning and sustainable development

This study seeks to contribute to the existing body of knowledge on the relationship between urban quality and residential property prices in Dublin by addressing these research aims. In addition, the research findings are expected to provide valuable insights into the specific urban quality-related factors that influence property prices in the city, inform urban planning strategies, and contribute to the development of sustainable and liveable communities in Dublin.

1.3 RESEARCH OBJECTIVES

- To identify and analyse key urban quality indicators influencing Dublin residential property prices.
- To examine the spatial configuration of Dublin and its impact on residential property prices, considering factors such as proximity to accessibility, services and social infrastructure, and the public realm.
- To estimate the marginal price effects of specific urban quality indicators on residential property prices in Dublin using econometric modelling techniques.
- To investigate the perception and preferences of residents regarding urban quality factors and their willingness to pay for properties with higher urban quality attributes.
- To provide recommendations and insights for policymakers, urban planners, and real estate investors on enhancing urban quality and promoting sustainable, liveable communities in Dublin.
- To contribute to the academic literature on the relationship between urban quality and residential property prices, particularly in Dublin, Ireland.
- To explore the potential implications of the findings for urban development strategies, housing policies, and investment decisions in Dublin's real estate market.
- To contribute to the broader understanding of the importance of urban quality in residential property markets and its implications for cities' overall liveability and economic sustainability.

1.4 RESEARCH METHODOLOGY

The research methodology employed in this study adopts a mixed-methodological approach to investigate the relationship between urban quality and residential property prices. The implemented methodology follows a two-phase multi-methodological approach. In Phase 1, a Spatial Multi-Criteria Analysis (SMCA) is developed and executed, comprising six stages ranging from problem definition to data overlay. This phase involves conducting a comprehensive literature review, refining the research question, sourcing relevant data, processing and analysing the collected data. ArcGIS Pro is extensively used in this Phase, along with Visual Studio Code for web scraping purposes. Phase 2 focuses on valuation through econometric modelling, consisting of three stages: preparation for valuation, actual hedonic pricing model and review. This phase utilises the data acquired and processed in Phase 1 and employs SPSS (a statistical software suite developed by IBM) to conduct a hedonic pricing model. Finally, the review entails reviewing the outcomes of Phase 2. This phase addresses the research question and provides insights into the examined field's implications, relevance for experts, and decision-making considerations.

1.5 LIMITATIONS OF THE STUDY

This study has several limitations that should be acknowledged. Firstly, the findings may have limited generalisability beyond the specific context of Dublin. The city's unique characteristics, including its spatial configuration, historical heritage, economic factors, and cultural context, may restrict the applicability of the results to other cities or regions. Secondly, the study outcomes rely heavily on the availability and quality of data sources. Limitations in data accessibility, completeness, or accuracy could impact the validity and reliability of the findings. Obtaining comprehensive and up-to-date data on property prices, urban quality indicators, and other relevant variables may present challenges. Thirdly, establishing a causal relationship between urban quality indicators and residential property prices is complex. Endogeneity issues, such as bidirectional relationships or omitted variables, may influence urban quality and property prices. Appropriate econometric techniques should be employed to address potential endogeneity.

Additionally, assessing urban quality involves subjective judgments and preferences. Different individuals may have varying perceptions of urban quality, introducing potential biases in the analysis. The study incorporates subjective measures such as residents' perceptions and preferences, which may introduce subjectivity and variability. Furthermore, the analysis of urban quality indicators may be limited to specific factors or dimensions due to data limitations or the chosen research framework. Although efforts will be made to include a comprehensive set of indicators, some aspects of urban quality may still need to be fully captured or considered. It is also important to note that the study focuses primarily on the relationship between urban quality and residential property prices. It may not account for other external factors influencing property prices, such as macroeconomic conditions, housing policies, or market dynamics. These external factors may interact with urban quality and independently affect property prices. In addition, given the complexity and time-consuming nature of analysing urban quality and its impact on property prices, the study's scope and depth may be limited due to time constraints. Finally, the chosen research methodologies, including econometric modelling and spatial analysis techniques, have inherent limitations and assumptions. These methodologies may only capture some of the complexities and nuances of the urban quality-property price relationship, further highlighting potential limitations in the analysis.

Acknowledging these limitations will provide a more nuanced interpretation of the findings and guide future research and refinement.

2 CHAPTER 2: THE URBAN QUALITY AND RESIDENTIAL PROPERTY - LITERATURE REVIEW

2.1 WHAT IS URBAN QUALITY?

The United Nations estimates that the world population is expected to reach 9.8 billion inhabitants in 2050, with about 68% of them living in urban areas (United Nations, 2018). (D'Alpaos & Andreolli, 2020) state that uncontrolled growth of cities can have a variety of adverse and positive effects on citizens' health, the environment, and the economy. Generally, it is found that urban quality is a term used to describe the general standard of life and degree of comfort in a city. It covers a range of aspects of urban life, such as the physical layout and usability of structures and public areas, the availability of essential services like transportation, healthcare, and education, the presence of leisure and recreation facilities, the preservation of environmental resources, and the degree of safety and security. Urban quality also considers social and cultural aspects, such as the population's diversity and cultural richness, the degree of civic involvement and the quality of local links, and the accessibility of jobs and other economic opportunities. With this forecasted rapid urbanisation, the proliferation of urban inequalities can be reinforced and exacerbated by a lack of focus on creating and maintaining what constitutes good urban quality.

2.2 WHAT IS URBAN QUALITY IN A EUROPEAN UNION (EU) CONTEXT?

Urban quality in an EU context refers to the extent to which cities and metropolitan areas within the EU provide high living standards, working conditions, and overall quality of life for their residents. The EU defines urban quality as a combination of social, economic, environmental, and physical factors that contribute to the well-being of urban residents and the functioning of cities as centres of growth and innovation.

In practice, this includes factors such as:

- Access to affordable and adequate housing
- Access to good quality public transport and sustainable mobility options
- Access to education and employment opportunities
- Access to green spaces, recreation, and cultural amenities
- Environmental sustainability, including the reduction of air and noise pollution and the provision of green infrastructure.
- Safety and security, both physical and perceived
- Cultural Diversity and social cohesion

The EU recognises the importance of promoting urban quality to address the challenges facing cities and urban areas, including population growth, urbanisation, and the changing needs of residents. Through initiatives such as the European Urban Agenda, the EU works with cities and other stakeholders to promote best practices in urban development and support sustainable, inclusive cities and provide a high quality of life for their residents. Additionally, The EU under the 2030 Climate Target has stressed the urgent need to improve people's quality of life and municipal operations in 2014, along with defining targets (updated in 2018) to mitigate the consequences of climate change, increase the share of renewable energy sources, and improve energy efficiency by 2030.

2.3 WHAT IS URBAN QUALITY IN AN IRISH CONTEXT?

The prevailing document in the Irish context is the Urban Design Manual is a guide that provides a framework for urban design in Ireland. Produced in 2007 by the Department of Housing, Local Government and Heritage and was a companion document to Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas. The document is intended to be used by architects, planners, engineers, developers, local authorities, and other stakeholders involved in the design and development of urban areas in Ireland.

The critical elements of the manual (Fig 1) are set out under three key sections with twelve criteria underpinning and encapsulating the range of design considerations needed to inform a high urban quality.

1. A neighbourhood is described as the “area” in which people already live or the space where people wish to live. The most prosperous neighbourhoods have good access to employment centres or locations where people spend their free time. They are places where anyone can reside, regardless of their physical condition or social standing, at any stage of life. A successful neighbourhood will typically offer a wide range of activities and have a solid connection to its surroundings, whether that relationship be historical, cultural, or aesthetic.

2. The site is found within the neighbourhood. It is considered the layout, public realm and intensity of development, which adds to the creation of strong communities. It also represents a different scale of interaction to that of Neighbourhood.

3. Home should be sufficient in size to enable people to live comfortably through different stages of their lives and should have high amenities that make living there pleasurable.

The manual guides various urban design issues, including designing streets and public spaces, integrating buildings and open spaces, providing public transport and sustainable mobility options, and creating attractive, safe, and sustainable urban environments. The manual also includes recommendations for the design of specific types of urban spaces, such as town centres, residential areas, and parks and green spaces.

The Irish Urban Design Manual is an essential resource for those developing urban areas in Ireland, as it provides a consistent and comprehensive approach to urban design aligned with the objectives of national policy and international best practices. It is intended to support the creation of high-quality urban environments that are attractive, sustainable, and provide a high standard of living for their residents.

Figure 1 The Design Wheel (Urban Design Manual, 2009)

2.4 Academic Perspective on Urban Quality

From an academic perspective, urban quality is a multidisciplinary and complex concept studied and debated by scholars from various fields, including urban planning, sociology, geography, economics, and architecture.

In urban planning, urban quality is often considered concerning the physical and built environment, including the design and layout of cities, the availability and accessibility of public spaces and transportation, and the provision of affordable housing. Sociologists and geographers view urban quality from a social and spatial perspective, examining issues such as community engagement and cohesion, the distribution of resources and opportunities, and the impact of urbanisation on rural areas. Economists consider urban quality in terms of economic performance and competitiveness, including the availability of jobs, the level of income and entrepreneurship, and the provision of public services and infrastructure. Finally, architects and urban designers focus on the aesthetic and sensory aspects of urban quality, such as the quality of public spaces and buildings.

Despite the different perspectives, scholars have a growing consensus that urban quality is a complex and dynamic concept encompassing a range of interrelated physical, social, economic, and environmental factors. Therefore, a holistic and integrated approach must be effectively understood and improved.

Originating in research and policymaking traditions, urban quality, liveability, quality of life, and sustainability often overlap. The investigation of these concepts and their definitions reveals that they all pertain to the relationship between people and the natural environment and focus on how urban design elements can enhance urban quality (van Kamp et al., 2003). Urban quality is primarily concerned with the social and physical quality of the urban public domain, emphasising the potential for creating livable and aesthetically pleasing environments for people (Tiesdell et al., 1996; Chapman & Larkham, 1999). To investigate the relationship between urban quality and urban design and to refine the concept of urban quality, this study

analysed the primary research lines in urban design studies. The American and British traditions of urban design theory and practice constitute a multidisciplinary arena that has enriched the concept of the urban environment's spatial quality. North American author Jacobs (1961) sheds light on urban design, quality, and decadence. Her research emphasises the significance of several concepts, such as the functional mix, which keeps the streets lively and active throughout the day, the small dimensions of the blocks, which facilitate movement, and the variety of building types. In the same era, Lynch (1960) emphasised the significance of the visual dimension of cities and the perceptions of their inhabitants, highlighting the connection between urban space and social dimensions. Southworth (2003) emphasises the significance of the physical form of a neighbourhood to its liveability and long-term performance as a place to live. For instance, a city is highly liveable when its quality and character of public areas, walkability and bicycle access, street grid and block size connectivity, and access to parks, schools, libraries, and local businesses are all present. Smith et al. (1997) also attempted to link the quality of a society's physical forms to its social and psychological traits. He has created a matrix in which the concepts of liveability, personality, connection, mobility, freedom, and diversity relate to physical and social quality and are described by specific criteria. Significantly, Bosselman (2008) introduced a multidisciplinary approach to urban planning based on the study of social, economic, political, and environmental factors. Bosselman's urban design theory revolves around concepts such as a sense of place, which gives people a sense of belonging and has the potential to enrich their identities. Vitality refers to the advantage derived from the proximity of other people, while liveability focuses on the perception of concrete physical elements. Urban design studies emerged in response to the poor quality of cities caused by post-World War II urban development. In this context, it is essential to discuss (Carmona, 1996) and his critique of contemporary architecture, emphasising the absence of social connection. During the 1970s and 1980s, the private sector dominated urban development without significantly highlighting urban quality concerns. This lasted until the 1990s (Rowely, 1998), when the government began emphasising urban planning as a discipline and public policy as the key to achieving economic competitiveness via urban development. The British government has also implemented a sustainable urban development strategy in recent decades as part of the national design agenda (Carmona et al., 2001). According to Carmona et al. (2002), the prevalence of sustainability principles and the intensifying competition among cities has prompted the United Kingdom's urban planning and policies to emphasise well-designed and managed urban environments that contribute to the economic attractiveness of places.

The theoretical foundations of Gehl (2010, 2011) are closely tied to the social dimension of the American tradition and have also made substantial contributions to our understanding of urban quality. Gehl has proposed three types of open space functions based on his research into the systematic observation of city residents and the shifting use of public spaces: required, voluntary, and social. Voluntary activities include staying outside, sitting, and sunbathing, as opposed to required activities with work and daily tasks. Social activities require the presence of individuals in public spaces.

2.5 URBAN QUALITY: TAXONOMY AND ASSESSMENT TOOLS

Urban quality taxonomy is a classification system or framework for categorising and defining various elements contributing to an urban area's overall quality of life. This taxonomy helps to identify and understand the different factors that make up urban quality, including physical, economic, social, environmental, and governance aspects. Urban quality assessment tools are methods or instruments used to measure and evaluate the level of urban quality in a specific area. These tools can take various forms, including:

- Surveys: questionnaires that gather information from residents, workers, or visitors about their perceptions and experiences of urban quality
- Indices: numerical scores or rankings that reflect the level of urban quality in a specific area based on a set of indicators or criteria
- GIS-based tools: Geographic Information System (GIS) applications that use spatial data and mapping to visualize and analyse various aspects of urban quality, such as land use patterns, transportation networks, and environmental conditions.

Research studies often adopt indicator-based frameworks and rating systems to assess urban quality. They are similar as they ground on selecting and measuring some indexes or indicators, which are subsequently aggregated according to a set of criteria. These approaches are the most used by practitioners, as they are well-known and well-established in literature; nonetheless, they lack an integrative perspective (Cohen, 2017). Decisions related to assessing urban quality in future cities can be addressed as a decision-making problem, where multiple aspects, often conflicting, must be accounted for. Multi-criteria Decision Making (MCDM) methods have been extensively proposed in the literature to support urban planners in defining new sustainable policies (Oppio et al., 2018) in the European Union. The development of these ranking systems (e.g., the European Smart Cities ranking, the European Green Capital Award, the European Green City Index, Europe Quality of Life Index) has been widely supported, and they still present some methodological gaps, as demonstrated by Akande et al. (2019). The urban environment has been described and measured using a variety of instruments, which have all been considered. They have been developed to accomplish various goals, including establishing and monitoring levels of sustainability, aiding real estate or traffic evaluations, increasing community awareness regarding the environment, and initiatives connected.

Assessment Tool	Author	Year	Country	Research Type
A Citizen's Guide to LEED for Neighborhood Development	U.S. Green Building Council	2012	United States of America	Observation
Active Neighbourhood Checklist	Active Living Research	2007	United States of America	Observation
BREEAM Communities	BREEAM	2012	United Kingdom	Factual
Healthy Neighbourhood Audit Instrument	City Futures Research Centre	2016	Austrialia	Observation
ITACA protocol	ITACA	2014	China	Factual
Neighbourhood Active Living Potential (NALP)	Professionals	2002	Canada	Factual
Pedestrian Environment Data Scan (PEDS) Tool	(Clifton and Smith, 2007)	2007	United States of America	Observation
Physical Activity Resource Assessment (PARA)	UNDO Projects	2005	United States of America	Observation
PIN3 Neighborhood Audit Instrument	Evenson et al	2009	United States of America	Observation
Quality Housing for Sustainable Communities	Department of the Environment, Heritage and Local Government	2007	Ireland	Observation
Systematic Pedestrian and Cycling Environmental Scan	Active Living Research	2000	USA	Observation
Urban Design Evaluation Framework (UDEF)	Te Tupu Ngātahi	2022	New Zealand	Factual
Walk Score	Walk Score™	2012	United States of America	Factual

Table 1 Urban Quality Assessment Tools

Adding to the research, Table 1 illustrates each analysed instrument's distinctive urban realm related characteristics. Each evaluation tool has a unique set of criteria for approaching different types of research; in fact, they were developed for various purposes, although they share some features. Even after a cursory examination, this collection of urban environment characteristics reveals recurrent themes and numerous application sectors. Table 2 below breaks down the contents of each of these urban quality assessment tools into attributes contributing to the public realm.

Attributes	Public Green Space	Tree Rows	Coast line	Seats & Benches	Public Lighting	Noise	Air Quality	Monuments	Architectural Heritage	Conservation Area	Public Allotments	Vacant & Derelict Sites
A Citizen's Guide to LEED for Neighbourhood Development	x	x		x	x	o	o	o	o	o	o	x
Active Neighbourhood Checklist	x	x		x	x	o	o	o	o	o	o	x
BREEAM Communities	x	x		x	x	x	x	x	x	x	o	x
Healthy Neighbourhood Audit Instrument	x	x		x	x	x	x	x	x	x	x	x
ITACA protocol	x	x		o	x	o	o	o	o	o	o	o
Neighbourhood Active Living Potential (NALP)	o	o		o	x	o	o	o	o	o	o	o
Pedestrian Environment Data Scan (PEDS) Tool	o	x		x	x	o	o	o	o	x	o	x
Physical Activity Resource Assessment (PARA)	x	x		x	x	o	o	o	o	o	x	o
Neighbourhood Audit Instrument (PIN3)	x	x		o	x	o	o	o	o	o	o	x
Quality Housing for Sustainable Communities (QHSC)	x	x		o	x	x	o	x	x	o	x	o
Systematic Pedestrian and Cycling Environmental Scan (SPACES)	o	o		o	x	o	o	o	o	o	o	o
Urban Design Evaluation Framework (UDEF)	o	x		o	x	x	o	o	o	o	o	x
Walk Score	o	o		o	o	o	o	o	o	o	o	o

Table 2 Urban Quality Assessment Tools Relationship with Public Realm

2.6 URBAN QUALITY: DUBLIN CITY DEVELOPMENT PLAN 2022 – 2028

The Dublin City Development Plan 2022-2028 is a statutory document that outlines the vision, policies, and objectives for the development and growth of Dublin City over the next six years. It serves as a vital planning tool, guiding decisions regarding land use, infrastructure, and overall development in the city. For ease of interpretation, the author will refer to the Dublin City Development Plan 2022 – 2028 as *"the Plan"*.

The Plan's main objective is to ensure that Dublin develops in a sustainable, inclusive, and well-planned manner, considering the social, economic, environmental, and cultural needs of its residents and businesses. The plan aims to create a vibrant and liveable city that improves the quality of life, preserves heritage and natural assets, supports economic growth, fosters social cohesion, and addresses the challenges posed by climate change.

The Plan covers various aspects of urban development, including land use zoning, transportation, housing, economic development, environmental protection, heritage conservation, community facilities, open space provision, and infrastructure requirements. It sets forth policies and objectives that guide decision-making processes, influences development proposals, and provides a framework for stakeholder coordination.

Cities worldwide adopt comprehensive strategies to promote sustainable urban development, preserve cultural heritage, and enhance residents' quality of life, and Dublin is no exception. The Plan is crucial in steering the city's evolution and ensuring a balanced approach to urban quality amidst dynamic transformations and urban challenges.

Developed through a collaboration between Dublin City Council (DCC), stakeholders, and the local community, the Plan is a strategic framework for the city's future development. It outlines policies and objectives that shape Dublin's physical and social aspects, serving as a blueprint for land use, infrastructure, transportation, housing, environmental protection, and heritage preservation.

The Plan's primary purpose is to provide a cohesive vision and framework to address the evolving needs and aspirations of the city. The plan aims to achieve a sustainable and inclusive urban environment that promotes economic vitality, social cohesion, and environmental stewardship by establishing policies and guidelines. It aligns with national policies, regional strategies, and local priorities to respond to Dublin's challenges and opportunities.

Comprising policies and objectives, the Plan provides a framework for decision-making and guides the city's development and management. Policies are broad statements that express desired outcomes and principles for various aspects of development, addressing issues like sustainable development, heritage preservation, transportation, housing, economic development, environmental protection, and social inclusion. Objectives, on the other hand, are specific and measurable targets that support policy implementation. They provide detailed directions and actions, serving as milestones to monitor progress and evaluate the plan's effectiveness. In addition, objectives guide resource allocation, strategy formulation, and project implementation across different sectors.

Understanding the Plan is crucial for comprehending the city's trajectory, aspirations, and efforts to ensure urban quality. The plan's significance lies in its ability to shape land use patterns, determine infrastructure provision, preserve cultural heritage, guide development decisions, and safeguard the city's natural and built environment. In addition, it serves as a reference for investors, developers, policymakers, and citizens, providing a framework to align their actions with the city's long-term vision.

The Plan is a comprehensive document divided into chapters, each focusing on the city's growth and improvement. These chapters address themes such as land use, transportation, housing, heritage, environment, economic development, and community engagement. The Plan outlines each chapter's goals, objectives, and policies to guide decision-making and ensure coherence across sectors. It also includes specific actions, implementation strategies, and monitoring mechanisms to track progress and adapt to changing circumstances. In addition, the plan embraces a collaborative approach, incorporating input from experts, stakeholders, and the public to foster transparency and inclusivity in the planning process.

The Plan is crucial in shaping the city as Dublin continues to evolve.

2.6.1 Accessibility

Under the Plan, accessibility in the context of Dublin's public transportation pertains to the city's inhabitants' safe mobility, contributing to a more liveable city. Access to public and active mobility options includes Dublin Bus, Luas (Light rail), Irish Rail, Dublin Bike stations, and cycle lanes. The Plan acknowledges the pivotal role of accessibility in fostering healthy and sustainable communities and underscores the significance of providing and enhancing these facilities across the city.

Moreover, the Plan strongly emphasises ensuring that the accessibility associated with public transportation remains accessible and inclusive to all community members, irrespective of their age, ability, or cultural background, as exemplified by the Accessibility for All policies and objectives outlined in the Plan.

DCC accept responsibility for the seamless integration of land use and transportation within the planning system. Central to this objective is the effective management of access and mobility. A critical challenge for DCC lies in acknowledging the significant role of transportation in fostering sustainable and liveable communities. This entails minimising the necessity for travel and strategically locating development in areas where active modes of transportation can be successfully encouraged while ensuring convenient access to high-quality public transport networks. By addressing these considerations, DCC seeks to establish a foundation for sustainable urban development that prioritises efficient mobility, reduced reliance on private vehicles, and enhanced accessibility for all community members.

The overarching policy and objective are to establish a public transportation and active mobility network characterised by convenience, efficiency, and equitable access, enabling individuals from diverse backgrounds to navigate and connect with different areas of the city while concurrently advancing sustainability goals and reducing reliance on private transportation.

It is the Policy of DCC:	
SMT1	**Modal Shift and Compact Growth**
SMT3	**Integrated Transport Network**
SMT4	**Integration of Public Transport Services and Development**
SMT5	**Mobility Hubs**

2.6.1.1 Dublin Bus

DCC indicate that the bus is the backbone of the transport system and will continue to be crucial in future transportation planning. It complements the investment in the rail network by extending its catchment through feeder services and interchange. The National Transport Authority (NTA) has initiated programs like Bus Connects to improve the bus system and increase public transport usage significantly. Bus Connects is a comprehensive program that includes the development of core bus corridors, a new bus service network, next-generation ticketing, improved bus infrastructure, and a low/zero emissions bus fleet. The NTA has identified key radial corridors and plans to submit applications for 12 schemes, improving bus journeys and making the system more convenient. The strategy includes orbital bus routes and additional priority measures to cater to increasing demand. The New Dublin Area Bus Network, finalised in September 2020, is based on feedback from three rounds of public consultation and will be implemented in phases over several years. The network consists of spines, orbitals, city-bound routes, local routes, peak-only routes, and express routes, providing better connections and more efficient services. The plan will be periodically reviewed to accommodate changing development and transport patterns. The strategy also acknowledges the need for additional bus services to serve Dublin Airport, especially in anticipation of the delivery of future public transport.

It is both policy and objective of the Plan to work with the NTA in delivery of bus infrastructure as set out in the Greater Dublin Area Transport Strategy (GDATS) 2022-2042.

It is the Policy of DCC:	
SMT22	**Key Sustainable Transport Projects** BusConnects Core Bus Corridor projects

It is an Objective of DCC:	
SMTO18	**Bus Infrastructure**

2.6.1.2 Luas (Light-rail)

The reintroduction of tram services in Dublin has been a major focus in the city's transportation plans since 1994. The construction and expansion of the Luas Red and Green lines have been successful, providing enhanced connectivity, increased frequencies, and positive impacts on the urban environment. Light rail lines, such as the Luas, are more cost-effective compared to underground metro or heavy rail lines, making them a viable option for a city like Dublin. A network of multiple high-capacity lines, combining bus and light rail, is a more feasible solution for Dublin's size and density. The outlined by the GDATS approach allows a larger population to be directly served with high-quality public transport. It also offers the flexibility to incrementally transition from bus to high-capacity bus or light rail along corridors based on demand.

It is a sub-policy of the Plan to work with the NTA in delivery of key sustainable transport projects including the Luas to Finglas as set out in the GDATS 2022-2042.

It is the Policy of DCC:	
SMT22	**Key Sustainable Transport Projects** • Luas to Finglas • Luas to Poolbeg and Lucan

2.6.1.3 Irish Rail / DART (Heavy rail)

The heavy rail network, particularly the east coast suburban line, has historically been the main backbone of Dublin's transport system. In 2019, there were 35.6 million journeys on Dublin Commuter and DART services, indicating its importance.

The DART+ Programme aims to expand the existing electrified DART network from 50km to 150km to meet growing demand and increase train capacity. It includes four main projects: DART+ West, DART+ South-West, DART+ Coastal North, and DART+ Coastal South. These projects involve electrification, corridor widening, station enhancements, depot construction, elimination of level crossings, and other improvements.

DART+ West focuses on the Maynooth line, integrating with the MetroLink project at Glasnevin. DART+ South-West involves electrifying the Kildare Line and addressing constraints in the Phoenix Park tunnel. DART+ Coastal North includes electrification and re-signalling from Malahide to Drogheda. DART+ Coastal South focuses on eliminating level crossings and enhancing station capacity at Bray and Greystones.

It is a policy of the Plan to work with the NTA in delivery of key sustainable transport projects including the DART+ as set out in the GDATS 2022-2042.

It is the Policy of DCC:	
SMT22	**Key Sustainable Transport Projects** DART +
SMT23	**The Rail Network and Freight Transport**

It is an Objective of DCC:	
SMT017	**Additional Interchanges and Rail Stations**

2.6.1.4 Now Dublinbikes

Shared mobility refers to commuters' communal use of devices or vehicles (such as bikes, scooters, cars, and vans) for transportation purposes, providing a transportation mode between private ownership and traditional public transport. The NOW Dublinbikes scheme is the most established example of shared mobility in the city, consisting of 117 stations and a fleet of 1,600 self-service bikes, including hybrid electric bikes. Celebrating its 10th anniversary in September 2019, the scheme has facilitated over 34 million journeys.

It is the Policy of DCC:	
SMT24	**Shared Mobility and Adaptive Infrastructure**

It is an Objective of DCC:	
SMT022	Shared Bike Schemes and Micro-Mobility Schemes

2.6.1.5 Cycle lanes

The Plan recognises the significance of providing pedestrian-friendly infrastructure, ensuring accessibility, legibility, and a positive pedestrian experience. It prioritises reallocating space to pedestrians and integrating them into the city's movement network. DCC view cycling as a transformative mode of transportation that enhances health and environmental well-being. The Plan aims to build upon the existing success of cycling in the city by increasing its mode share and fostering a cycling culture. Various measures, such as shared bike schemes, an expanded cycle network, promotional campaigns, speed calming measures, and accessible cycle parking, are acknowledged for their positive impact in promoting cycling. The Plan also emphasises providing secure and centrally located cycle parking facilities, including cargo and adapted bike provisions. In addition, collaboration with the Active Travel Programme Office and the Greater Dublin Area Cycle Network Plan will contribute to developing a comprehensive cycle network.

It is the Policy of DCC:	
SMT16	Walking, Cycling and Active Travel
SM19	Integration of Active Travel with Public Transport

It is an Objective of DCC:	
SMT08	Cycling Infrastructure and Routes
SMT09	Greater Dublin Area Cycle Network Plan

2.6.2 Services / Social Infrastructure

Under the Plan, social infrastructure refers to the physical facilities and services that support the community's social well-being. These include community centres, libraries, sports facilities, healthcare, playgrounds, and public amenities such as public toilets and water fountains. The plan emphasises the importance of social infrastructure in creating healthy and sustainable communities and calls for providing and improving such facilities throughout the city. Additionally, the program highlights the need to ensure that social infrastructure is accessible and inclusive for all community members, regardless of age, ability, or cultural background.

2.6.2.1 Childcare

DCC will encourage providing high-quality and suitable childcare services for creating sustainable communities. The government provides guidelines to local authorities on where to locate childcare facilities, including residential areas, educational establishments, and public transport hubs. The guidelines recommend one childcare facility for every 75 residential units, with the flexibility only provided for valid reasons. For example, preschool facilities near areas with high air pollution levels should incorporate mitigation measures into their design, and outdoor play areas should not be near busy roads. The council will work with childcare committees to support the government's goal of providing high-quality and affordable childcare services.

It is the Policy of DCC:	
QHSN55	**Childcare Facilities**

It is an Objective of DCC:	
QHSNO19	**Pre-School Facilities**

2.6.2.2 Sports Facilities

DCC aims to increase physical activity among its residents and workers to improve their health and wellbeing, create a sustainable environment, and promote social cohesion. The council will renew and develop sport and recreation facilities throughout the city, support community and private organisations in providing such facilities, and work with the Dublin City Sport and Wellbeing Partnership to promote physical activity through targeted programs and initiatives. The council is also committed to providing local, accessible, and inclusive opportunities for children and young people to play, in line with the United Nations Convention on the Rights of the Child. The city's public streets, footpaths, and cycleways provide access to major recreational amenities, parks, and open spaces, promoting sustainable travel modes and wider regional recreation and tourism objectives.

2.6.2.3 Schools (Primary & Post-Primary Schools) & Universities

DCC upholds that providing education facilities is crucial for creating sustainable and inclusive communities in Dublin, and demographic needs must align with educational provision. The Council will collaborate with the Department of Education and Skills to ensure that new and improved schools and education facilities are in areas easily accessible by public transport, walking, and cycling routes. They will also promote innovative school designs that efficiently use urban lands and provide adequate play, sport, and recreational amenities. They will also support the appropriate development and/or redevelopment of existing schools, including multi-campus development that enhances existing facilities.

To comply with these requirements, DCC mandates a social and community audit in planning applications for developments of over 50 dwellings. A report must identify the demand for school places and the capacity of existing schools. For large-scale developments of 800+ units, the phased completion of the dwellings must be linked with the provision of new schools. In determining an application for a school, compliance with various guidelines and codes of practice must be considered. School sites should be in a manner that aids ease of access and encourages sustainable mobility. Multi-campus schooling arrangements may be considered in appropriate cases. Urban typologies for new schools should be promoted to efficiently use urban land and address the surrounding context while providing appropriate external hard and soft play areas. Additionally, the Council recognises the importance of public and private 3rd-level education and training institutions to the city.

It is the Policy of DCC:	
QHSN53	**Education Provision**

2.6.2.4 Libraries

The Dublin City Library Development Plan 'Libraries Unlimited: A Strategic Direction for Dublin City Libraries 2019-2023' acknowledges the crucial role of public libraries in providing information and services to the citizens, visitors, and workers of Dublin. With 23 branches already in operation, the Council aims to ensure that the libraries continue to meet the needs of local communities. Therefore, the Council will continue to support improving and expanding library facilities in the city.

It is the Policy of DCC:	
QHSN55	**City's Library Service**

2.6.2.5 Public Toilets

DCC will encourage and support the provision of public facilities such as toilets and water fountains in the city's public areas, including new urban quarters. Public toilets should be located in visible positions and include facilities for cleaning. Security and management should also be considered, with attendants' rooms recommended. The design should be robust and vandal-resistant, with wheelchair accessible and unisex units provided, and baby changing facilities. Showers may also be provided in some locations.

It is an Objective of DCC:	
QHSNO19	**Civic Amenities** (i) To provide civic amenities such as accessible public toilet facilities and drinking water at suitable locations in new or redeveloped public realm.

2.6.2.6 Sports Facilities

DCC aims to increase physical activity among its residents and workers to improve their health and well-being, create a sustainable environment, and promote social cohesion. The council will renew and develop sports and recreation facilities throughout the city, support community and private organisations in providing such facilities, and work with the Dublin City Sport and Wellbeing Partnership to promote physical activity through targeted programs and initiatives. The council is also committed to providing local, accessible, and inclusive opportunities for

children and young people to play, in line with the United Nations Convention on the Rights of the Child. The city's public streets, footpaths, and cycleways provide access to major recreational amenities, parks, and open spaces, promoting sustainable travel modes and wider regional recreation and tourism objectives.

It is the Policy of DCC:	
GI46	To Improve and Upgrade/ Provide Access to Sports / Recreational Facilities
GI49	Protection of Existing and Established Sport and Recreational Facilities

2.6.2.7 Healthcare-related Services / Social Infrastructure

DCC will support the provision of public and private healthcare facilities, community support services, and multi-disciplinary healthcare. The Council will also facilitate healthcare authorities in the development of accessible community-based healthcare and the enhancement of hospitals and healthcare facilities. The Health Service Executive (HSE) is responsible for managing healthcare facilities in Dublin, with additional provision from other healthcare providers. Government plans prioritise improving access to care, promoting health, and addressing health inequalities. The National Planning Framework focuses on developing acute hospital services, community healthcare services, and integrated health/social care services. Regional policy highlights gaps in healthcare infrastructure that must be addressed to meet the needs of a growing and ageing population.

It is the Policy of DCC:	
QHSN13	Healthy Dublin City Framework and the Healthy Ireland Framework 2019-2025
QHSN52	Sláintecare Plan

2.6.2.8 Museums

The Council aims to continue supporting the growth and expansion of cultural resources, including museums, particularly where proposals increase engagement with local communities, young people, marginalised groups, and people with disabilities. These institutions play a vital role in shaping the future of arts and culture in Dublin and provide opportunities for people, especially children, to engage with and experience art and culture.

It is an Objective of DCC:	
QHSNO19	Museum of Dublin

2.6.3 Public Realm

The public realm refers to all the spaces within a city or town that are accessible to the public, such as streets, sidewalks, parks, plazas, and plots. They also consider the invisible factors which affect our enjoyment of the space. These spaces are essential for various reasons, including facilitating movement and access to different destinations, providing opportunities for social interaction and recreation, and contributing to the overall quality of life in a city or town. In Dublin, the public realm is crucial in shaping the city's urban centres and overall liveability. The quality of the public realm directly impacts how people experience and perceive the city, influencing factors such as its attractiveness as a place to live, work, and visit and its residents' health, well-being, and social connectivity. To ensure that the public realm in Dublin is safe, accessible, and inclusive, the DCC is working on several projects and initiatives in collaboration with infrastructure providers and developers. These projects are guided by the Dublin City Public Realm Strategy 'Your City Your Space,' which sets out principles for delivering a high-quality public realm that is easy to navigate and promotes safety, accessibility, and inclusivity.

A high-quality public realm is designed to meet the needs of its users in several ways. First, it should integrate sound urban design principles into the layout and design of new developments, creating attractive spaces that support the broader goals of the development plan. It should also provide a sense of place, carefully designed spaces appropriate to their context, character, and location. Second, a high-quality public realm should be legible, connected, and permeable, encouraging people to walk and cycle to their destinations and easily access public transport. This promotes physical activity and helps people lead healthier lives. Third, the public realm should be designed for comfort, ease of movement, and inclusivity, focusing on the needs of pedestrians, disabled people, the elderly, and others with specific mobility requirements. Universal design principles should guide the public realm and aim to provide equitable access to everyone. Fourth, a high-quality public realm should provide social interaction and recreation opportunities, from large civic spaces to small micro-parks and pop-up parks. Fifth, safety is a critical consideration in the public realm. It should be carefully managed and maintained to deter anti-social behaviour and crime and ensure people feel safe using these spaces. Sixth, the public realm should be designed using high-quality materials that are fit for purpose, durable, and sustainable. Green infrastructure, including urban greening features, should also be incorporated into public spaces to promote visual amenities and climate resilience. Finally, installing civic amenities, such as seating, public toilets, and water fountains, can provide essential facilities for residents, workers, and visitors and should be encouraged where appropriate.

It is envisaged that DCC will continue to invest in the public realm, developing strategies and initiatives that support a high-quality, accessible, and inclusive urban environment for all residents and visitors.

There are multiple policies of DCC related to the public realm. These policies are aimed at promoting walking as the preferred means of movement, delivering high-quality and inclusive streets and public spaces, creating a permeable and connected public realm that contributes to sustainable movement and green infrastructure, promoting public safety, using a design-led approach in infrastructure projects, moving to a low traffic environment in the city centre, providing environmental and public realm improvements in the city and ensuring that new development proposals create linkages and connections and improve accessibility. Overall, the goal is to create vibrant, attractive, accessible, and safe places that meet the needs of the city's diverse communities.

It is the Policy of DCC:	
CCUV37	Plan Active and Healthy Streets
CCUV38	High Quality Streets and Spaces
CCUV39	Permeable, Legible and Connected Public Realm
CCUV40	Public Safety
CCUV41	New Infrastructure Development
CCUV42	Public Realm – City Centre
CCUV43	Public Realm - Key Urban Villages/Urban Villages
CCUV44	New Development

2.6.3.1 Public Green / Open Space

The City of Dublin has a range of parks and open spaces, including formal parks, green open space areas, woodlands, and civic spaces. These areas are vital for improving residents' quality of life and well-being by providing attractive places to relax, socialise, and play. The Council's Parks Strategy indicates the sufficient provision of parks per population at the city-wide level, but deficits have been identified locally. To better respond to the growing population, new parks will be provided to deliver new growth areas in the city. Additionally, there will be a focus on improving the accessibility and quality of existing parks and open spaces, including increasing permeability to public open spaces. Food growing occurs in various locations across the city and is supported by initiatives such as community gardens and urban farms, providing locally grown food and social, community-oriented physical activities for all age groups and abilities.

It is the Policy of DCC:	
GI25	Open Space Provision (sq. m.) per 1,000 Persons Benchmark
GI26	Securing Acquisition of Additional Public Open Space
GI27	Addressing Public Open Space Deficits in Identified Areas

It is an Objective of DCC:	
GIO22	Dublin City Parks Strategy
GIO23	Manage / Protect / Enhance Parks
GIO24	Public Open Space Audit
GIO25	Facilities and Amenities in Parks/Public Open Spaces

2.6.3.2 Coastline

DCC's coastline, particularly Dublin Bay, is a valuable asset that contributes to the city's environment, economy, recreation, culture, and tourism. The bay encompasses a diverse

range of coastal landscapes, amenities, and natural heritage of international, European, and national significance. It provides opportunities for nature conservation, recreational activities, and coastal settlements, including Dublin Port and critical infrastructure. However, the vulnerability of these coastal areas to climate change necessitates a careful balance between their potential for future economic development, tourism, recreation, and energy resources, and the need to protect their natural heritage and water quality.

In recognition of its importance, Dublin Bay and its surrounding area have been designated as a UNESCO Biosphere Reserve since 2015. The UNESCO Biosphere Reserve aims to promote the coexistence of biodiversity conservation and sustainable use. It serves as a learning area for sustainable development, integrating the conservation of biodiversity and cultural diversity, sustainable economic development, and logistic support through research, monitoring, education, and training. The management of the UNESCO Biosphere Reserve is carried out by the Dublin Bay Biosphere Partnership, which includes key stakeholders such as local councils, Dublin Port Company, tourism authorities, and wildlife services. Their collaborative efforts focus on understanding and maintaining the intricate relationship between human activities, cultural aspects, and ecological dynamics in Dublin Bay.

It is the Policy of DCC:	
GI35	General Protection of Coastal Zone
GI36	Recreational and Tourism Amenities

It is an Objective of DCC:	
GIO36	Providing Coastal Recreational Amenities
GIO6	Metropolitan and Local Greenways

2.6.3.3 Tree Rows

DCC's urban forest includes street trees, garden trees, trees in parks, open spaces, hedge lines and woodlands, providing many benefits to the city such as cleaning air, water management, creating habitats, storing carbon, cooling the environment, masking noise, and promoting well-being. The 2017 Dublin Tree Canopy Study found that the city has 300,000 trees covering 10% of its land area but identified low canopy covers in certain areas. Ecological surveys and habitat management plans have been prepared, and a new Dublin Tree Strategy will establish urban forestry plans, increase tree cover, and prioritise locations for tree planting.

It is the Policy of DCC:	
GI40	Tree Planting - General
GI42	Tree Management
GI44	Resilient Urban Forest

It is an Objective of DCC:	
GIO41	**Dublin City Tree Strategy 2016**
GIO43	**Urban Tree Canopy Plan**

2.6.3.4 Seats & Benches (Seating)

DCC also aims to control the location and quality of structures like newspaper stands, telephone kiosks, and signs to create a high-quality public environment. Private operators and utility companies are required to provide street furniture of the highest quality, preferably with a contemporary design that respects the character of the area and does not obstruct footpaths. Licensing or planning permission is necessary for street furniture, with details of location, design, maintenance, and accessibility for disabled individuals. The planning authority considers factors such as size, location, visual impact, streetscape character, effects on neighbouring premises, and access and visibility when reviewing applications for outdoor furniture.

DCC also emphasises the need to de-clutter and repurpose the public spaces in the city centre and urban centres to prioritise pedestrians and cyclists. They aim to promote healthy placemaking and enhance the attractiveness and accessibility of these areas. Investment in the public realm involves improving and widening paths, creating seating and rest spaces, planting trees, and providing opportunities for people to spend time and enjoy the surroundings. The goal is to create vibrant and inviting environments that cater to the needs of all individuals.

It is an Objective of DCC:	
CCUVO15	**City Centre Public Realm Strategy**
CCUVO20	**Civic Amenities** (i) To provide public seating based on universal design in appropriate locations in the public realm in the city. Seating for older people with mobility issues will be based on international models of good practice.

2.6.3.5 Public Lighting

DCC acknowledges that high-quality, smart, and energy-efficient public lighting plays a significant role in improving people's experience of the city. It enhances their sense of place, safety, and security. Artificial lighting offers valuable advantages to society, such as extending opportunities for sports and recreational activities. Moreover, it can be crucial for new developments, contributing to their functionality and appeal. DCC recognises the importance of prioritising the provision of efficient and effective public lighting to benefit residents and visitors alike. DCC seek to carefully design public lighting to strike a balance between providing sufficient illumination, ensuring safety, maintaining a pleasant environment, and considering environmental factor.

The Council ensures that public lighting is designed appropriately to balance the need for sufficient lighting with amenity and environmental concerns. Significant lighting proposals must demonstrate that they won't negatively impact the surrounding area and should provide details of light levels and mitigation measures. Public lighting, including on public roads, should adhere to the latest standards and minimise impact on protected species. Applications for new

roads and public spaces should ensure adequate lighting for accessibility and safety. Development proposals for public lighting should include details of column height, location, lantern type, lighting specifications, and a site lighting report to assess light overspill. Construction lighting and its impact on surrounding properties should be considered and included in the construction management plan.

It is the Policy of DCC:	
SI41	Lighting Standards

2.6.3.6 Noise

DCC is responsible for managing noise levels in the city in compliance with the EU Environmental Noise Directive and the Environmental Noise Regulations. To ensure compliance, the Council prepared strategic noise maps for the city in 2017 in collaboration with other Dublin local authorities. These maps provide a comprehensive overview of the noise levels across the city and are used to inform the Dublin Agglomeration Environmental Noise Action Plan 2018 – 2023.

The Noise Action Plan outlines various initiatives to reduce the harmful effects of long-term exposure to daytime and night-time environmental noise from road traffic, rail, and industrial sources. These initiatives are prioritised to ensure that the areas with the highest levels of noise pollution are addressed first. The Noise Action Plan and noise maps are reviewed every five years to ensure they remain relevant and practical.

The council has designated eight Quiet Areas in Dublin City. These areas are typically city parks and green spaces with low environmental sound levels. The Noise Action Plan aims to protect these areas from future increases in environmental noise so that they remain tranquil and quiet.

The council has the authority to control noise-intensive developments and keep them away from more sensitive residential areas through the planning system. Additionally, where a proposed development is likely to create disturbance due to noise, the planning authority can impose a planning condition limiting the hours of operation and noise generation level to reduce noise pollution.

It is the Policy of DCC:	
SI35	Ambient Noise Quality
SI36	Noise Management
SI39	Protection of Designated Quiet Areas

It is an Objective of DCC:	
SIO23	Dublin Agglomeration Environmental Noise Action Plan
SIO24	Noise Monitoring and Enforcement
SMTO36	Environmental and Road Safety Impacts of Traffic in the City

2.6.3.7 Air Quality

The City Council must monitor Dublin's air quality through a network of local air pollution sensors. While Dublin's air quality is generally good, there are concerns about levels of nitrogen dioxide. The Council has prepared an Air Quality Management Plan to improve nitrogen dioxide levels and has committed to achieving World Health Organization air quality guidelines by 2030. The Department of Environment, Climate and Communications is developing a National Clear Air Strategy, and the Council plans to support its implementation at a city level. Cross-sectoral policy responses are required to protect air quality, including reducing fossil fuel-based energy use and increasing urban greening. Sustainable design and construction practices can also help to reduce emissions from new buildings.

It is an Objective of DCC:	
SIO21	**Air Quality Data Collection**
SIO22	**City Ambient Air Quality Monitoring Network**

2.6.3.8 Monuments & Protected Structures

Within the DCC (DCC) jurisdiction, an estimated count of 8,500 protected structures can be found, all duly recorded in the comprehensive inventory known as the Record of Protected Structures (RPS). These protected structures are accorded their status based on their exceptional architectural, historical, archaeological, artistic, cultural, scientific, social, or technical significance. It is important to note that no hierarchical categories or grades are assigned to these structures, as each one is considered individually based on its intrinsic merit.

The scope of protection extends beyond the mere exterior of the structures and encompasses their interior spaces, fixtures, and distinctive features. Moreover, any structures situated within the boundaries of a protected structure, along with their respective interiors, also benefit from this safeguarding measure. The inclusion of a structure in the RPS does not preclude alterations in terms of use, development, or extensions, provided that such modifications do not detract from the essential character and contextual integrity of the protected structure.

As part of the city's commitment to the preservation of its architectural heritage, efforts are actively made to support conservation endeavours aimed at repairing and adapting these structures for sustainable long-term utilisation. It is worth emphasising that obtaining planning permission is a prerequisite for any undertaking that significantly impacts the character of a protected structure. However, certain minor works may be exempted from the planning permission requirement if they do not materially compromise the distinctive character or special interest of the structure in question.

2.6.3.9 Conservation Area

Currently in the DCC jurisdiction there are 24 Architectural Conservation Areas (ACA's) in the city, designated on the zoning maps. Development within these areas must respect the existing character, protect the streetscape and features, and enhance the overall appearance. Much ACA's contain significant protected structures, streetscapes, and views.

It is the Policy of DCC:	
BHA7	**Architectural Conservation Areas**

2.6.3.10 Public Allotments

DCC understands that providing allotments and community gardens significantly facilitates food production within urban areas, thereby contributing to reducing food kilometres and fostering sustainable practices. Moreover, establishing networks for sustainable travel modes, such as dedicated cycle routes, promotes active transportation and helps mitigate carbon emissions associated with conventional modes of transport.

Food cultivation in urban settings occurs in various locations, including private back gardens, allotments, parks, vacant and temporary sites, and rooftops. Community gardens, allotments, and urban farms serve as valuable spaces that foster social interactions, community engagement, and physical activity across diverse age groups and abilities. Furthermore, these spaces enable the production of locally grown food, promoting food security and reducing reliance on external sources. Additionally, utilising vacant lands for food production contributes to their activation and revitalisation, enhancing the overall livability and sustainability of urban areas.

In order to fully support the cultivation of food within the city, it is crucial to allocate growing spaces within residential developments, leverage rooftops for agricultural purposes, and utilise temporarily vacant land for food production. Initiatives like "Eat the Streets" (available at https://www.eatthestreets.ie/dublin) that promote urban food growing initiatives should be endorsed and encouraged, as they further facilitate community involvement and local food production.

In summary, the incorporation of allotments, community gardens, and sustainable travel networks in urban areas plays a vital role in fostering local food production, reducing carbon emissions from transportation, and promoting community well-being. Supporting initiatives that utilise available urban spaces for food cultivation and encouraging participatory engagement in these activities contribute to the overall sustainability and resilience of the city.

It is an Objective of DCC:	
GIO28	**Urban Farming and Food Production**

2.6.3.11 Derelict Sites

The Derelict Sites Act of 1990 provides a clear definition of a derelict site as any land that significantly diminishes, or has the potential to significantly diminish, the quality, character, or visual appeal of the surrounding area. Within DCC, the implementation of the Derelict Sites Act involves a range of activities, including ongoing monitoring, regular inspections, site visits, and active engagement with relevant stakeholders.

In cases where the circumstances necessitate it, the council may pursue the use of Compulsory Purchase Orders as a potential measure for active land management. This approach enables the council to acquire derelict sites and initiate appropriate actions to address their neglect or adverse impact on the surrounding environment and community.

By utilizing the provisions of the Derelict Sites Act and considering the use of Compulsory Purchase Orders, DCC aims to combat the negative effects of derelict sites and improve the overall quality and attractiveness of the city. Through ongoing monitoring, inspections, site visits, and collaboration with stakeholders, the council takes proactive steps to identify and address derelict sites, ensuring that they are appropriately managed and, if necessary, brought into productive use for the benefit of the community and the urban environment.

It is an Objective of DCC:	
CSO11	Derelict Sites Act and Compulsory Purchase

2.6.3.12 Vacant Sites

DCC's Active Land Management Unit, in accordance with the Urban Regeneration and Housing Act 2015 (amended), established the Vacant Sites Register on January 1, 2017. This legislative framework includes the provision for a levy on vacant sites, which serves as a crucial measure in implementing the core strategy of the council.

The presence of vacant development sites in Dublin presents both challenges and opportunities for the city to address the pressing need for additional housing, employment opportunities, and other land uses. The Vacant Site Levy, as a mechanism, aims to activate underutilized land that is categorized as vacant but zoned for potential uses that can optimize land resources and contribute to a more efficient and sustainable urban land management approach. Its ultimate goal is to facilitate the realization of a compact and consolidated city form.

The implementation of the Vacant Site Levy within DCC involves various operational activities, including monitoring, inspection, site visits, and engagement with relevant stakeholders. These efforts ensure effective enforcement of the levy and promote the activation of vacant sites for productive land use. For further information on zoning objectives and vacant sites, Chapter 14 of the city's development plan provides detailed guidance and outlines the criteria that determine whether a site can be classified as vacant.

In summary, the establishment of the Vacant Sites Register and the implementation of the Vacant Site Levy by DCC's Active Land Management Unit represent significant measures to address the challenges posed by vacant development sites. By activating these underutilized lands, the council aims to achieve a more compact and consolidated city form while optimizing land resources for housing, employment, and other beneficial uses. The ongoing monitoring and engagement activities ensure the effective implementation of the levy and support the council's objectives in land management and urban regeneration.

It is an Objective of DCC:	
CSO8	Promote Active Land Management
CSO9	Vacant Sites

2.7 CHARACTERISTICS THAT INFLUENCE URBAN QUALITY

Accessibility, services & social infrastructure, and the public realm have been recognised as the primary characteristics influencing urban quality (see Fig 2). The first recalls the availability and localisation of public transportation, the second focuses on the localisation of primary and secondary services, and the third comprehends the broad spectrum of open space quality determinants, which comprise most of the thirteen tools analysed characteristics.

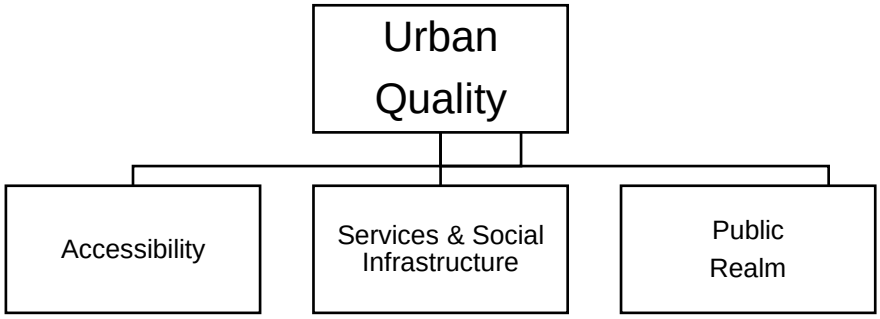


Figure 2 Characteristics of Urban Quality

The public realm is a complex topic to tackle for several reasons: it contains a vast amount of data that may be potentially addressed, it cannot be easy to comprehend how to evaluate its attributes, and it is a highly subjective field. The research will be based on the frequency and reclassification of the tool's features into attributes, as depicted in Table 2.

Regarding the public realm, the most influential factors are walking and cycle lanes connected safely. The presence of green features, such as parks and permeable spaces, and street furniture, especially if it provides cover, has a significant influence. Also visible is the significance of the urban fabric in terms of connectedness and interchange hubs, which allows for the easy switching of modes of transportation.

2.8 EVALUATION FRAMEWORK

Urban quality assessment is a topic that has the delicate task of combining different aspects of the urban environment. Often, we think about urban quality in terms of the city's physical structure, considering factors such as the street design and the materials used. Several tools have been developed to satisfy specific requests, creating a sectoral view on walkability issues, energy efficiency, and transits. This work aims to understand which other elements can influence urban quality, giving a comprehensive spectrum of the fields in which it is made.

Following the literature review conducted in Chapter 2, it is possible to define urban quality within these three main spheres: “Accessibility”, “Services & Social Infrastructure”, and "Public Realm". Accessibility and Services & Social Infrastructure are two essential ingredients for the city's and public realm's functionality, contributing to a higher degree of liveability.

2.8.1 Accessibility

Transport accessibility is a vital aspect of defining urban quality. An efficient and reliable transport system connects people to their workplaces, schools, healthcare facilities, and other essential services. It facilitates the movement of people, goods, and services within a city or urban area, which is crucial for economic growth and social development. An accessible transport system ensures all citizens can move around the city quickly and efficiently. This includes people with disabilities, older people, the elderly, children, and low-income individuals who may not have access to private vehicles.

Moreover, it promotes social and economic inclusion, reduces inequalities, and contributes to a sustainable urban environment. Cities with well-designed and accessible transport systems tend to have better urban quality than those with poorly designed and inadequate transport systems. Such cities often have efficient public transportation networks, safe cycling and pedestrian paths, and adequate parking facilities.

For the purpose of this study, accessibility is defined by the combination of Dublin Bus Stops, Luas (Light rail) Stops, Irish Rail Stations, Dublin Bike Stations, and Cycle Lanes.

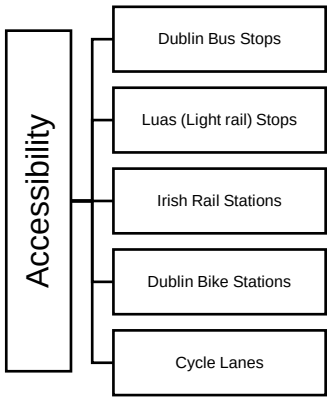


Figure 3 Selected Accessibility Attributes

2.8.2 Services & Social Infrastructure

Social infrastructure & services are an essential factor that can impact urban quality. Services such as healthcare, education, and public safety play a crucial role in determining the liveability and amenity of a city or neighbourhood. Access to quality healthcare services can improve the health and well-being of residents, making a city or neighbourhood more equitable. Access to quality education services, such as public schools and universities, can significantly attract families and young professionals to a city or neighbourhood, making it more desirable and valuable. The availability and quality of public safety services, such as police and fire stations,

can significantly determine a city's overall safety and security, making it desirable to inhabitants. Furthermore, a well-developed network of services can improve the quality of life for residents by providing access to essential services and improving the overall liveability and amenity of a city or neighbourhood.

However, it is worth noting that the impact of the social infrastructure & services on urban quality can vary depending on various factors, such as the local economy, population demographics, and the availability of other amenities. In some cases, a lack of services in a city or neighbourhood can result in disparities in access to essential services and lower quality of life for specific populations, negatively impacting the overall urban quality.

For the purpose of our research, Services & Social Infrastructure are defined as the following public, private, and non-governmental services:

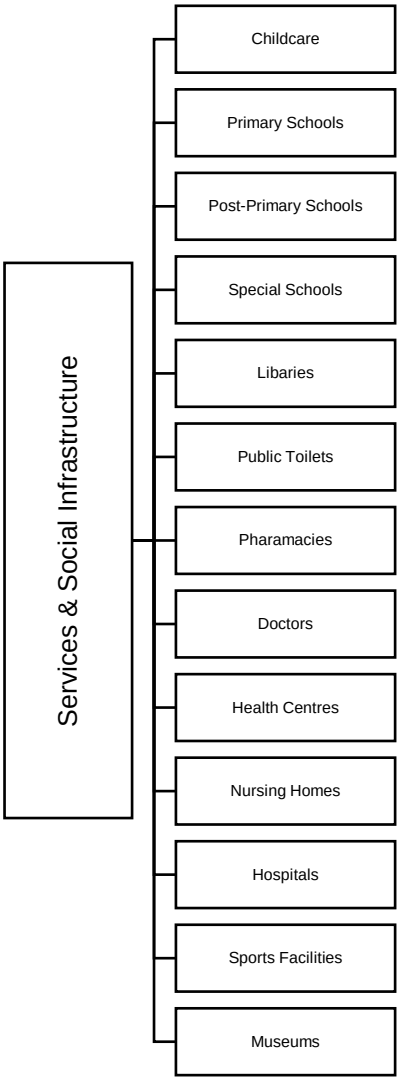


Figure 4 Services & Social Infrastructure Attributes

2.8.3 Public Realm

The evaluation of this field is not so explored nor consolidated in the literature. From the analysis presented in Chapter 2, Public Realm has been defined as articulating twelve attributes. The attributes related to the public realm each play a vital role in shaping the urban environment and enhancing the quality of life in a city. These aspects include air quality, coastline, architectural conservation areas, derelict sites, monuments and architectural heritage, noise levels, public allotments, public green spaces, public lighting, seats and benches, and tree rows.

Air quality focuses on the cleanliness and pollution levels of the air, which is crucial for maintaining the health and well-being of residents. The coastline represents the land areas bordering bodies of water, offering scenic views and recreational opportunities. Architectural conservation areas aim to preserve specific zones' historical, cultural, and architectural significance, safeguarding the city's heritage. Derelict sites, however, require attention for their revitalisation and redevelopment potential. Monuments and architectural heritage sites hold cultural and historical value, enriching the city's identity and attracting visitors. Noise levels in the urban environment are necessary to manage as excessive noise can impact well-being. Public allotments provide designated areas for individuals or communities to cultivate produce, fostering community engagement and promoting food security. Public green spaces, such as parks and gardens, offer opportunities for relaxation, recreation, and social interaction, contributing to the overall well-being of residents. Public lighting ensures safety and visibility in public areas, particularly during night-time. Seats and benches provide places for rest, socialising, and observation, enhancing the usability of public spaces. Lastly, tree rows contribute to aesthetic appeal, environmental sustainability, and air quality improvement in urban areas.

These attributes are the initial stage of analysis. They contain raw data expressing a straightforward concept. Even though data processing has been required in some instances, most cases involve data that does not need to be elaborated.

Scale is significant here, and how the case is analysed determines the selection of the attribute.

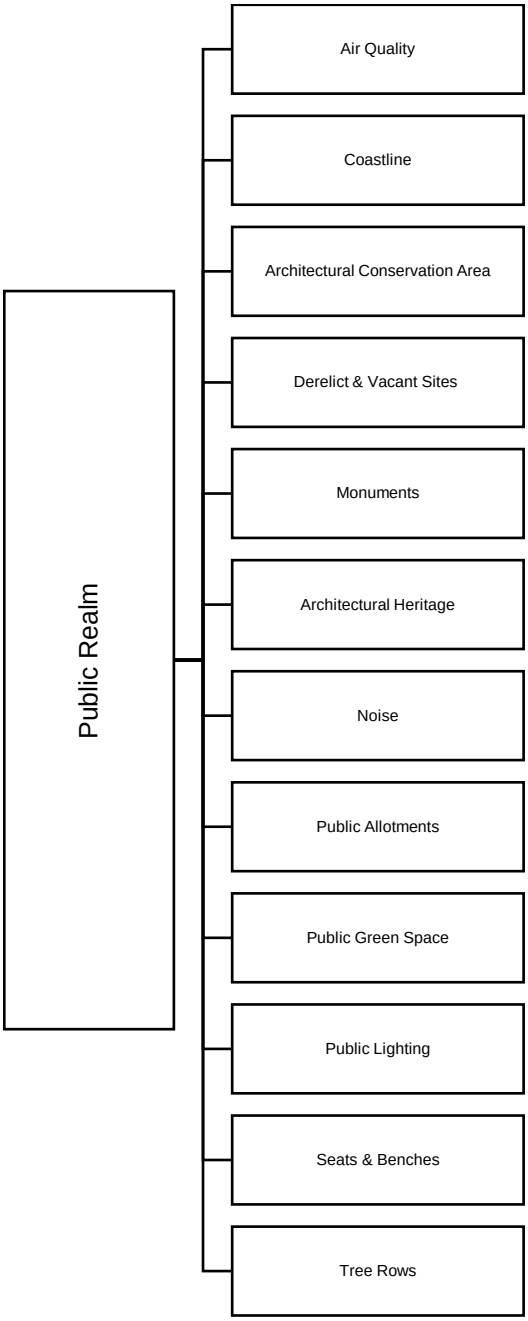


Figure 5 Public Realm Attributes

2.9 URBAN QUALITY: RELATIONSHIP RESIDENTIAL PROPERTY PRICES

The relationship between urban quality and residential property is complex and can be influenced by various factors. However, in general, urban quality can have a significant impact on the demand for and value of residential property.

Urban quality refers to a city or neighbourhood's overall liveability and amenities. It includes factors such as access to public transportation, availability of parks and green spaces, proximity to schools, and local crime rates. A city or neighbourhood with high urban quality is often seen as more attractive to residents, leading to increased demand for housing and higher property values.

On the other hand, low urban quality can result in lower housing demand and property values. For example, areas with high crime rates, poor public transportation options, or inadequate public services may be less desirable to residents, leading to lower property values and a declining housing market.

It is also worth noting that the relationship between urban quality and residential property can vary depending on the local economy, population demographics, and housing supply and demand. In some cases, high urban quality may result in gentrification and displacement of lower-income residents, negatively impacting the local community and housing market.

2.9.1 Accessibility

Accessibility is a crucial link between urban quality and residential property. People base their location decisions mainly on the availability of employment and amenities (Alonso, 1964; Muth, 1971; Brueckner, 1987). Increased accessibility, as a result of, for instance, new transport infrastructure, enables individuals to work and live in locations that match their talents and requirements (Gelauff et al., 2017). Accessibility reduces transportation costs and supports agglomeration economies via matching, sharing, and learning for businesses (Puga, 2010). Combined, these factors frequently result in concentration in economic centres. Accessibility is a concept utilised in many settings and study domains, and as such, it may be defined in various ways. As per Geurs & van Wee (2004), the structure of accessibility is comprised of land use, the transit system, time resources, and the individual's unique resources. Hence, accessibility links the residence to the surrounding or city-/region-wide land uses, transportation networks, and activity venues. Hence, allowing individuals to participate in events at many locations (van der Vlugt et al., 2019)

Alonso (1964) is renowned for coining the access-space-trade-off model. The distance to a central business district is the key accessibility variable influencing home pricing. However, this paradigm has been criticised for failing to function in a polycentric spatial configuration. It is also troublesome since household members frequently work in different regions (Heikkila et al., 1989). Thus, it may be claimed that access to transit infrastructure or hubs (from which several sites are easily accessible) is more vital. Nevertheless, research on the importance of accessibility to public transportation (buses, metro, light rail, and trains) has yielded inconsistent results.

Debrezion et al. (2011) discovered, on a national scale, a correlation between home values and accessibility to railway stations: residential properties located closer to a train station command a more significant premium than those located further away. The report also emphasises the significance of frequency, which will not be addressed in depth throughout the course of this investigation. This is the price premium supported by Medda & Modelewska's (2009) examination of the economic effects of the current metro line on Warsaw, Poland's home prices. According to their analysis, residential properties within 1km of the nearest metro station have a premium of 6.7% compared to those in the same district

but further away. Similarly, Efthymiou & Antoniou (2013) studied the interaction between transportation infrastructure and property sales values in Athens, Greece. The authors determined that residential properties located 500m around the metro stations have premiums between 6.74% and 11.66%. Forrest et al. (1996) examine the Greater Manchester, UK Metrolink. They compare data before and after completion and find no discernible impact. In a study of Dublin, Ireland, it was found that there was the largest premium for light rail (LUAS), followed by the train station (DART) and commuter transit (Mayor et al., 2008). Being within 500 meters to 2,000 metres of light rail in Dublin commanded a premium of 7% and 17%. However, they also found a correlation between close proximity and decreased costs, perhaps due to noise pollution. This is illustrated in the research conducted by Efthymiou & Antoniou (2013), with property located 500m from ISAP stations (above heavy rail) having sale prices from -10.20% to -12.24%.

Nevertheless, service levels (train frequency, railway network connection, and service coverage) considerably favourably impact residential property values. Moreover, the effect of closeness to a train station is greater in low-income neighbourhoods than in high-income neighbourhoods, according to further studies on accessibility (Bowes & Ihlanfeldt, 2001). Adair et al. (2000) also see a similar intra-urban differential impact in Belfast, Northern Ireland, UK. They conclude that accessibility has little impact on home costs on a citywide scale but has a big impact on submarkets.

The public transportation mode of buses and its impact on property prices has been explored worldwide with varying levels of consistency (Yang et al., 2019). According to Koutsopoulos (1977), just a few bus lines in the United States cannot give price premiums. Yang & Shyr (2019) found that multiple authors (Vuchic, 2002), (Cervero & Kang, 2011), (Pang & Jiao, 2015) suggested that frequent buses could not result in price increases for property. According to So et al. (1997), in Hong Kong, buses have trouble providing meaningful accessibility advantages, although when a property is located within 1km of a bus station, it commands a premium of 3.2%. Cao and Hough (2008) and Wen and Tao (2015) found that in a small metropolitan region in the United States or Hangzhou, China, the impact of proximity to bus routes is even negative within 1 km. These findings are in striking contrast to those of Ibeas et al. (2012), Wang et al. (2015) and Efthymiou & Antoniou (2013) in the European cities of Santander, Spain, Cardiff, Wales, United Kingdom, and Athens, Greece respectively. Ibeas et al. (2012) discovered a premium between 1.4% and 2.2% for each bus route within 400 metres or with no discernible impact. While Wang et al. (2015) found that for every additional bus stop within 1500 metres of a property, there was a 0.22% price premium. Bus stops, and property values are higher, ranging from 2.87% to 3.65%, with no proximity measurement outlined in the investigation (Efthymiou & Antoniou, 2013)

Bike sharing is an emerging way of accessibility that has not been as thoroughly evaluated as other modes of public transportation. Much of the study conducted on this topic originates from the United States and China. In Austin, United States, Li and Joh (2017) find that bike-sharing stations that improve bike-ability and transit accessibility can synergistically affect property prices. According to Chu et al. (2021), the introduction of dockless bike sharing reduces the underground premium in housing prices by approximately one-third. This is noteworthy because it highlights the disruptive effect inherent in the placement of bike-sharing stations, as well as the complimentary advantages when combined with regular public transportation alternatives. According to Liu et al. (2022), bicycle sharing has become an alternative to walking. According to Paauwe (2021), further research is required to determine the effect of bike infrastructure (e.g., cycle lane, bike lane, cycle track) on property prices. The majority of the study has been conducted in American cities. Shi (2017) analysis of Portland, USA and Racca & Dhanju's (2006) study of Delaware, USA, reveal the favourable effect of bike lanes

on residential property prices. According to Racca and Dhanju (2006), residential properties near 50 metres of bike routes exhibited a positive link with insurance premiums in the vicinity of 1%. Kashian et al. (2018) discovered that after installing a bicycle lane in Muskego, Wisconsin, property values rose by 8.6%. Nevertheless, not all bike lanes are created equal. The impacts explored by Connolly et al. (2019) in Franklin County, United States, reveal that on-road bike facilities linked to local open space have a premium effect on property values, whereas on-road bike facilities near bus stops have a discounting effect.

2.9.2 Services & Social Infrastructure

A strong correlation between school quality and household location preference (Black, 1999; Clapp et al.,2008). Li and Brown (1980) find a positive correlation between test scores and residential property prices in Boston, Massachusetts. In the United Kingdom, Gibbons et al. (2014) estimate that proximity to primary schools increases residential property prices by 2.2%. Mok et al. (1995) presented an intriguing evaluation of the school as a variable, describing it as having a negligible effect on property values. In certain contexts, according to Medda & Modelewska (2009), proximity to schools can result in a 6.9% reduction in home prices.

Yang et al. (2018) illustrates that accessibility and proximity to hospitals are associated with lower housing prices at -2% to -3.8% when examining the city of Xiamen, China. This is consistent with Huh & Kwak's (1997) study in Seoul revealed that hospitals significantly negatively affect property prices. The presence of a hospital in Seoul is detrimental due to Korean cultural traditions. The authors concluded that proximity to hospitals and health facilities is undesirable due to the disturbance that ensues, including the nuisance value of ambulance sirens, the general congestion surrounding hospitals, and superstitious beliefs. When examining Shanghai, China, Peng et al. (2015) derive the same negative impact of hospitals on property prices. Their rationale is based on the negative externalities of noise and air pollution, which will reduce residents' quality of life. Wong et al. (2017) theorise that it is older adults are more likely to go to the hospital and may live too close to hospitals for better access to more frequent visits. This notion of discount is consistent with and contradicted by Medda & Modelewska (2009) in their study of two distinctive districts in Warsaw, Poland. The Bielany district's negative correlation with proximity to hospital/clinic is found with a discount of 8.3% on property prices. In comparison, in the Targówek district, a marginal put positive correlation results in a 1.3% premium in property prices.

2.9.3 Public Realm Quality

Extensive and expanding research has been conducted on the effects of public open space on residential property values. Weicher & Zerbst (1973) wrote one of the earliest articles on the value of parks and public green space. In Portland, Oregon, in the USA, Bolitzer & Netusil (2000) discovered that public open space positively affects property value. Their research revealed a premium pricing effect of 4.09% for homes within 401 metres of green public space. In Salo, Finland, Tyrvainen & Miettinen (2000) found that distances up to 600 metres had a statistically significant positive amenity effect on property value, resulting in a 4.6% premium. Lutzenhiser & Netusil (2001) discovered that the amenity benefits of natural open spaces positively influenced the property values of adjacent properties. They discovered that homes within 457 metres of a natural area had statistically significant price premiums.

In contrast, homes between 121 and 180 metres from a natural park were priced 19.1% higher. They discovered that the highest premiums for urban parks occurred between 61 and 120 metres in urban areas. A growing body of literature on the effects of proximity to neighbourhood-style open spaces, such as urban parks, on home location and property value.

According to the few significant studies conducted in these countries, the United Kingdom and Ireland residents place a marginal value premium on open green spaces, which is reflected in the price they are willing to pay. Dehring & Dunse (2007) examined the impact of urban parks and amenity open spaces on residential property values in Aberdeen, Scotland. Overall, they found that the premium for a property adjacent to a park, compared to a similar property 450 metres away, is positive for all residential property types, with price premiums ranging from 0.44% to 19.97%, depending on the type of residential property and park.

Additionally, research indicates that proximity to neighbourhood public open space has a mixed or negative effect on price. In this context, Hendon's (1972) study of three parks in Fort Worth revealed that the average prices of properties located 153 metres from two parks were significantly higher than those located further away. Nonetheless, this study did not fully support the proximal principle, as the expected direction of the significant association was not observed in one park. Weicher and Zerbst (1973) compared properties near and facing a park to those adjacent to and backing into a park and properties close to different recreational uses and development levels. They discovered that residential properties adjacent to a park but separated by a street had higher value premiums than those that faced or backed onto a park, which either maintained or declined in value. They hypothesised that this was due to the negative effects of disturbances and nuisances adjacent to public open spaces, mainly when the area served as a gathering place for undesirable purposes. Hammer et al. (1974) studied the effect of a single larger park on the sales values of 336 Philadelphia, United States properties. They observed that property on corner lots or adjacent to a park was valued more favourably. However, neighbouring properties were assigned a negative coefficient due to the loss of privacy and other disruptions. Even though public appreciation of public spaces and improvements in security and maintenance have generally increased over the past few decades – because ongoing concerns about antisocial behaviour and youth crime allow these studies to remain relevant – public perception of a park can affect home values.

Numerous studies indicate that proximity to public green space is associated with negative externalities, such as the perception of danger and fear from anti-social behaviour (Jorgensen & Anthopoulou., 2007), crowding effects (Arnberger & Haider, 2005), conflicts between different user groups (Arnberger, 2006), inadequate maintenance (Fox, 1990), human destruction of vegetation (Kissling et al., 2009)

There is a considerable focus on the impact of noise related to airports on property values. The impact of airport noise was examined in Toronto, Canada, by Crowley (1973), where the author deduced that when the noise level stabilises, property prices adapt to the new conditions. The subsequent buyers buy the properties at discounted prices, thus compensating for the adverse effects caused by being located in the vicinity of an airport. Therefore, confirming a discount associated with proximity to airports and the noise generated by their activity. Li and Brown (1980), in the study of Boston, USA, did not confirm the negative correlation between noise level and property value. Trojanek and Glapska (2018) noted that many studies were conducted on the North American market. The authors perform literature review studies conducted in a European context where the noise depreciation index (NDI – defined as the percentage depreciation of property values due to a unit increase in noise exposure) ranges from 0.2% to 1.7%. Noise related to airports is not the only noise producer in our urban environment. Kopsch (2016) studied the difference in cost between aircraft noise and road noise using the estimates from the literature, out of which 44 were estimates for aircraft noise. The results indicated that aircraft noise costs an additional 0.40% and 0.60% more per increased dB than road noise.

Li et al. (2017) briefly explore air quality's role in the hedonic model and its effect on property prices. The examined the work of (Chay & Greenstone, 2005), noting that, in the USA, a one microgram per cubic meter decrease in total suspended particulates (TSPs) would result in a 0.2 – 0.4% increase in housing values. Bajari et al. (2012) find that coarse particles (PM10), sulfur dioxide (SO2) and ozone (O3) in California's Bay Area, USA, exhibit house price elasticity of −0.07, −0.16 and −0.60, respectively, while Shaaf and Erfani (1996) show that an increase in TSPs and SO2 leads to lower housing values in Jacksonville, Florida, USA. Scholars have also conducted studies on cities in developing countries, such as Jakarta, and have found that property values are significantly higher in areas with less air pollution (Yusuf & Resosudarmo, 2009).

As a neighbourhood characteristic, sports stadia can also impact the value of comparable properties. Ahlfeldt and Maennig (2009) provide a typology of stadium effects, categorised into effects related to their functionality as a sports venue or their exterior design and architecture (i.e. form). Among other things, stadium-related effects encompass spending effects by sports fans, consumption benefits from attending games, and civic pride. Feng and Humphreys (2008) find positive property price effects attributed to two stadia in Columbus, Ohio, USA. Similar findings have been documented on land values in Berlin (Ahlfeldt & Maennig, 2009). Ahlfeldt & Kavetsis (2014) found that with the construction of the new Wembley Stadium in London, UK, there was a significant increase in property prices close to the stadium of up to 15%, which gradually decreased the distance to the stadium.

Hedonic pricing has been used extensively to place values on cultural heritage goods, including conserving museum collections (Brown, 2004). However, most studies value historical, archaeological, and religious sites and buildings (Navrud & Ready, 2002).

The outcomes of this section of the literature review are summarised for ease of reading in Table 3.

2.9.4 Previous Studies in Dublin, Ireland

Several hedonic pricing studies have been conducted in Greater Dublin and Dublin, Ireland. The first example was published in 2008 and was authored by (Mayor et al., 2008). Their study examines the value of rail transport in the Greater Dublin Area and has been previously referenced in Chapter 2.9.1. The authors examined 6,956 property sales in Dublin collected between January 2001 and December 2006. They found that there was the most significant premium for light rail (LUAS), followed by the train station (DART) and commuter transit (Mayor et al., 2008). Being within 500 meters to 2,000 metres of light rail in Dublin commanded a 7% - 17% premium. While living very close to a train station (within 250m or 500m) results in a 7% - 8% premium, significantly less of a premium for heavy rail. However, they also found a correlation between proximity and decreased costs, perhaps due to noise pollution.

Interestingly, Mayor et al. (2008) found also in Dublin, Ireland, that ‘period’ residential properties (pre-1900s), often protected under Irish law, command a price premium of 9%. Moro et al. (2011), in their investigation into the impact of cultural heritage on housing markets, found that the greater distance to the nearest historic building in the Greater Dublin area negatively affects the property value under different specifications. Their investigation suggests that house prices decrease by 0.6 - 0.7% for every 100 meters from sites with heritage significance. Mayor et al. (2009), using the same dataset as (Mayor et al., 2008) when examining the value of parks and green spaces in Dublin, that the premium associated with a greener neighbourhood is between 7% and 9%, depending on the distance from the subject green area up to 2,000 metres. More recently, Stanley et al. (2016) examined the price effects of building energy ratings in Dublin. This study narrowed the investigation undertaken by (Hyland et al.,2013), which examined nationwide. Their study examined 2,792 residential

properties for sale in the Dublin region between January 2009 - June 2014. They found that a 1-point improvement in the 15-point scale from G to A1 yields a list price increase of 1%. Pilla et al. (2019), in the most recent hedonic pricing study conducted in Dublin, examine the impact of flood risk on property prices. The study uses a detailed dataset of over 650,000 sale and rental listings in Dublin, Ireland, from 2006–2015. The investigation found that being within the historical events zone has a negative effect on prices of 3.4%.

Reference	Data	Effects on Property Prices + = Premium - = Discount * = No evidence of effects
Accessibility		
Light/Heavy Railway		
Forrest et al. (1996)	892 property sales in Greater Manchester, UK	*
So et al. (1997)	1,234 property sales in Hong Kong in 1991	+
Adair et al. (2000)	2,648 residential properties in Belfast, Northern Ireland, UK during 1996	+
Bowes and Ihlanfeldt (2001)	22,388 sales of single-family homes in Atlanta, USA during 1991 and 1994	+
Mayor et al. (2008)	6,956 property sales in Dublin, Ireland between January 2001 and December 2006	+
Medda & Modelewska (2009)	1,130 property sales in Warsaw, Poland between 2006 and 2010	+
Debrezion et al. (2011)	40,326, 17,772 and 5,997 property sales in Amsterdam, Rotterdam, Enschede in the Netherlands	+
Efthymiou & Antoniou (2013)	8,066 property sales in Athens, Greece	+
Bus		
So et al. (1997)	1,234 property sales in 7 housing estates in Hong Kong during 1991	*
Cao and Hough (2008)	369 property rents in Fargo, USA in 2007	-
Ibeas et al. (2012)	1,562 property asking prices in Santander in June 2009	+
Wen et al. (2014)	609 property sales in Hangzhou in May 2012	+
Wen and Tao (2015)	229,340 and 649 property sales in Hangzhou in 2003, 2008 and 2011	-
Cycle Lanes		
Racca & Dhanju (2006)	150,000 residential property observations in Delaware, USA	+
Shi (2017)	17,163 residential property observations in Portland, Oregon, USA	+
Kashian, et al. (2018)	7,000 residential property observations in Muskego, Wisconsin, USA	+
Connolly, et al. (2019)	21,133 residential property observations in Franklin County, USA	+ & -

Reference	Data	Effects on Property Prices + = Premium - = Discount * = No evidence of effects
Services & Social Infrastructure		
Schools		
Li et al. (2016)	125 properties located within 1,000 subway three stations in Tianjin, China in March 2016	+
Black (1999)	A number of property transactions in Boston, USA in 1993	+
Clapp et al. (2007)	356,829 property transactions in Connecticut, USA, between 1994 and 2004	+
Li and Brown (1980)	781 property sales in Boston, USA in 1971	+
Gibbons et al. (2014)	1 million property transactions in the United Kingdom between 1996 and 2008	+
Mok et al. (1995)	1,027 property sales in Hong Kong in 1997	*
Medda and Modelewska (2011)	1,130 property sales in Warsaw, Poland between 2006 and 2010	-
Hospitals		
Yang et al. (2018)	22,586 residential property observations in Xiamen, China	-
Huh & Kwak's (1997)	235 residential property observations in Seoul, Korea	-
Yang et al. (2017)	1,250 residential property observations in Xiamen, China	+
Medda & Modelewska (2009)	1,130 property sales in Warsaw, Poland between 2006 and 2010	+ & -

Reference	Data	Effects on Property Prices + = Premium - = Discount * = No evidence of effects
Public Realm		
Public Green Space		
Bolitzer & Netusil (2000)	590 property sales in Salo and Halikko, Finland between 1984 and 1986	+
Tyrvainen & Miettinen (2000)	356,829 property transactions in Connecticut, USA, between 1994 and 2004	+
Lutzenhiser and Netusil (2001)	16,636 property sales in Portland, USA between 1990 - 1992	+
Dunse et al. (2007)	8,521 observations in Aberdeen, Scotland, UK	+
Mayor et al. (2009)	6,956 property sales in Dublin, Ireland between January 2001 and December 2006	+
Noise		
Crowley (1973)	A number of property transactions in Toronto, Canada in 1993	*
Li and Brown (1980)	782 property sales in Boston, USA in 1971	*
Trojanek and Glapska (2018)	15,572 property sales in Warsaw, Poland between 2008 - 2016	-
Air Quality		
Chay & Greenstone (2005)	A number of property transactions in the USA between 1970 - 1990	-
Bajari et al. (2012)	93,321 property transactions, in California, USA, between 1990 - 2006	-
Shaaf and Erfani (1996)	A number of property transactions in Jacksonville, Florida, USA in 1978	-
Yusuf & Resosudarmo (2009)	7,000 property transactions in Indonesia of which 470 observation in Jakarta in 1997/98	-
Ahlfeldt and Kavetsis (2014)	A number of property transactions in London, England, UK from January 1995 to July 2008	+
Heritage		
Moro et al. (2011)	6,956 property sales in Dublin, Ireland between January 2001 and December 2006	+
Mayor et al. (2008)	6,956 property sales in Dublin, Ireland between January 2001 and December 2006	+

Table 3 Urban Quality & Property Prices Literature Review Summary

3 CHAPTER 3: THE EVALUATION OF URBAN QUALITY & HEDONIC VALUATION MODEL ELABORATION – RESEARCH METHODOLOGY

The research methodology employed in this study adopts a mixed-methodological approach to investigate the relationship between urban quality and residential property prices. The implemented methodology follows a two-phase multi-methodological approach. In Phase 1, a Spatial Multi-Criteria Analysis (SMCA) is developed and executed, comprising six stages ranging from problem definition to data overlay. This Phase involves conducting a comprehensive literature review, refining the research question, sourcing relevant data, and processing and analysing the collected data. ArcGIS Pro is extensively used in this Phase, along with Visual Studio Code for web scraping purposes. Phase 2 focuses on valuation through econometric modelling, consisting of three stages: preparation for valuation, actual hedonic pricing model and review. This Phase utilises the data acquired and processed in Phase 1 and employs SPSS to conduct a hedonic pricing model. Finally, the review entails reviewing the outcomes of Phase 2. This Phase addresses the research question and provides insights into the examined field's implications, relevance for experts, and decision-making considerations.

3.1 MULTI-CRITERIA DECISION ANALYSIS (MCDA)

Multi-Criteria Decision Analysis (MCDA) is an *"umbrella term to describe a collection of formal approaches which seek to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter*" (Belton & Stewart, 2002, p.2). The primary aim of MCDA methods is "to investigate several choice possibilities in the light of multiple criteria and conflicting objectives" (Voogd, 1982, p.21). It links in with evaluating the performance of alternative courses of action (e.g., management or policy options) concerning criteria that capture the critical dimensions of the decision-making problem (e.g., ecological, economic, and social sustainability) involving human judgment and preferences. They are rooted in operational research and support for single decision-makers. Still, recently the emphasis has shifted towards multi-stakeholder processes to structure decision alternatives and their consequences to facilitate dialogue on the relative merits of alternative courses of action, thereby enhancing procedural quality in the decision-making process (Mendoza & Martins, 2006). Every analysis of this kind is unique, but they generally have some standard features (Hwang & Yoon, 1981):

- A variety of attributes
- Conflict between criteria
- Disparate measurement units
- Identification of the best alternative to solve the initial issue.

This approach's main achievement to support the author in their decision-making process. MCDA, as an example, can determine the potentiality of an intervention in the territory. Unlike evaluation techniques based purely on monetary assessments for possible territorial compatibility, MCDA responds with more accurate tools, combining criteria weighted on stakeholder priorities. This is a way to rationalise the process, helping decision-makers provide a method that combines monetary and non-monetary criteria (Ferretti, 2012).

Returning to the urban quality topic, information must communicate with the territory. Since the evaluation of urban quality is so related to the environment, the MCDA must connect data with their spatial dimension.

3.2 GEOGRAPHIC INFORMATION SYSTEM (GIS)

Geographic Information System (GIS) is a system that creates, manages, analyses, and maps all data types (ESRI, 2023). GIS gives decision-makers a robust collection of tools for manipulating and analysing spatial data. It is crucial to consider GIS as a set of tools for managing geographic data (Carver, 1991). With the evolution of technology and the increased appreciation of the importance of open data, the amount of information available is enormous. There are some concerns regarding this point, however. One must ensure they collect the correct information first, with high quality. It is also crucial that they concisely control the quantity of data, using those able to define criteria since this process must support the decision maker. The benefits of this method are the possibility to organise and store a vast quantity of geographical data and conduct operations directly applicable to the decision process inside a georeferenced environment.

Two ways to combine GIS and MCDA are loose coupling and tight coupling. In loose coupling, MCDA models are applied outside the GIS environment, which they enter only in a second phase just as a data visualisation and representation. Tight coupling, on the other hand, integrates the two processes and, with a unique model, allows faster and more direct exchange between GIS and MCDA. The negative aspect detected is the heavy calculus power needed for software that combines data representation and algorithm elaborations. Nevertheless, the Spatial Multi-Criteria Analysis (SMCA) or Spatial Multi-Criteria Evaluation (SMCE) is an advancement that combines the potentialities of two powerful tools.

3.3 SPATIAL MULTI-CRITERIA ANALYSIS (SMCA)

SMCA involves the methodological integration of GIS and MCDA. SMCA can be described as a process that combines and transforms several geographical data inputs into a resultant decision output. The outcome is aggregating multi-dimensional information into a single parameter output map, referred to as the decision map. This process encompasses geographical data and incorporates the decision maker's preferences and the manipulation of data and preferences based on specified decision rules. SMCA serves as a decision support tool that guides assessors, such as teams of experts and stakeholders, in structuring their problems and delineating their information requirements. While initially developed for complex business decisions, SMCA has increasingly been applied to spatial problems over the past three decades and has been used as the primary methodological tool in countless research exercises.

This study focuses on urban quality-related effects on house prices in Dublin, Ireland, by examining what constitutes urban quality in the context of Dublin and how said context impacts residential property prices.

While approaches have been developed to cater for the application of SMCA to date, only one has been developed for urban quality, and they have yet to be designed to deal with urban quality in the subject spatial context of Dublin, Ireland. Thus, this chapter examines frameworks in which SMCA plays an integral role. These approaches will provide insights into current successful practices used in SMCA and urban quality throughout the world in this way, providing a platform from which the author can begin to think about the purpose of this research study. These frameworks include the Malczewski (1998) framework & Oppio et al. (2020) framework.

Oppio et al. (2020) framework is a purpose-built theory for the investigation of urban quality. Oppio et al. (2020) is the overarching framework that combines elements of Malczewski (1998) framework to analyse urban quality chosen by the author and provides the vehicle for the subsequent research design.

This chapter will provide the foundation for the subsequent chapters in relation to the methodology employed in this investigation and for the discussion of significant insights/findings generated from the data.

3.4 HEDONIC PRICING MODEL

The hedonic linear regression pricing model (HPM) is primarily based on the work of Griliches (1961) and Rosen (1974) and arose from the development of value indices for manufactured goods that combined quantity and quality measures. Although, the theory behind hedonic price method originates from Lancaster's (1966) work that again linked consumer utility to the characteristics of goods, intended as the inputs in the activity of consumption. In his seminal paper, Griliches (1961) derived a hedonic price index for automobiles; the technique focuses on consumers' decisions regarding composite goods. The assumption is that goods are valued based on their utility-bearing characteristics and that these characteristics are internalised into the price of the good. A house, for instance, has several attributes, such as the number of rooms, bathrooms, and property size. Each of these characteristics contributes uniquely to the price of the home. In addition to house characteristics, neighbourhood characteristics also play a role in determining home prices. If a sufficiently large sample of housing market transactions is available, econometrics can be used to separate the implicit prices of the attributes. This is accomplished using a hedonic model of home prices. The fundamental method involves regressing the property price on quality-measuring variables while controlling for unobserved time and area effects.

Most of the research using hedonic pricing are based on an Ordinary Least Squared regression, most called linear regression. The OLS regression model takes the form of:

$$y_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip} + \epsilon_i$$

where:

y_i is the value of a dependent variable for i_{th} observation,

β_0 is the intercept term,

β_p is the regression coefficient of the p_{th} independent variable and,

ϵ_i is the model's error term or residual.

Recalling the hedonic model presented by Rosen (1974), the implicit marginal price of an attribute is presented as the partial derivative of the price function over the given attribute, which in the case of an OLS regression is equal to the value of an attribute's coefficient. Therefore, following the linearity of the model, the total value of an attribute p for an i_{th} observation (sound) is a product of the observation's value of p and β_0 coefficient.

However, to rely on a linear model's results, five main assumptions must be met:

- **The linearity of the data:** The relationship between the dependent and independent variables must be linear. This assumption can be checked by using a scatterplot comparing residuals of the model with fitted values.
- **Multivariate normality:** The residuals of the model should be normally distributed, which can be checked with a Q-Q plot or with a goodness of fit test such as the Kolmogorov-Smirnov test.

- **There is little to no multicollinearity in the data:** the independent variables should not be highly correlated. This assumption can be tested by calculating Pearson's correlation coefficients for each pair of predictors and with a Variance Inflation Factor (VIF).
- **Little to no autocorrelation:** The residuals of the model should not be correlated with each other, which can be checked with the Durbin-Watson test. However, the mentioned test only checks the correlation between directly neighbouring residuals. Therefore auto-correlation function should also be applied to ensure no higher-order effects.
- **Homoscedasticity:** The variance of error terms should be similar at all independent variable levels. Any significant indications of heteroscedasticity may be checked by analysing the plot of standardised residuals versus predicted values.

Generally, these factors can be divided into four main categories namely property attributes, neighbourhood attributes and locational attributes and time-related attribute (Abdullah & Mohd, 2022). In this investigation three of the four main categories are incorporated into the hedonic pricing model.

3.4.1 Property Related Variables

Numerous studies, including Malpezzi (2003), de Hann and Diewert (2013), and Diewert et al., (2015) shed light on the association between property-specific structural characteristics and housing prices. These papers discuss the impact of the structure type (e.g., house or apartment), liveable floor space, property size, building materials, number of bedrooms, number of bathrooms, the total number of rooms, number of parking spaces, building age, presence of a garage, presence of swimming pool, air conditioning, presence and/or type of heating, and number of floors.

Property Attributes / Variables
Number of rooms and type of rooms (bedrooms, bathrooms, etc.)
Floor area
Category (Single family, multifamily, attached, detached, number of floors)
Availability and type of heating and cooling systems
Age
Structural features (presence of basement, fireplaces, garages, etc.)
Structural material used, and quality of finish.

Table 4 Property Attributes / Variables (Source: (Malpezzi, 2003), (de Hann and Diewert, 2013), and (Diewert et al.,2015)

Selected Property Variables
The floor area (measured in square metres)
The number of bedrooms
The number of bathrooms
Type of dwelling (apartment, bungalow, detached, duplex, end of terrace, semi-detached, terrace, townhouse).

Table 5 Selected Structural Property Related Variables

3.4.2 Location Related Variables

In HPM, location attributes/variables are often conflated with the word ‘accessibility’, which concurs with the extent of our research methodology to this point. Lieske et al. (2021) elaborate on this conflation. The author states that the idea of proximity, usually measured as the distance from a residence to a train station, is destination desirability and variety, or where one can travel on public transport and is relative accessibility, which is defined in two distinctly different ways, as characteristics that differ between transit stations and as the differing levels of accessibility offered by different transport modes (Lieske et al. (2021).

Selected Location Variables
Dublin Area Code (Dublin 1, Dublin 2,...etc)

Table 6 Selected Location Related Variables

3.4.3 Neighbourhood Variables

Neighbourhood attributes/variables are the qualities of a neighbourhood or the surrounding area that affect a property's value. These characteristics may be physical or non-physical, and they may change based on the position of the property. The importance of the property's locale in determining its value cannot be overstated. Therefore, neighbourhood is more than locality of the property (Abdullah & Mohd, 2022). Furthermore, neighbourhood attributes refer to the location of the property such as proximity to school, amenities, transportation and town and they also indicate the surrounding such as view of the building (Freeman,1979; Aziz et al., 2023).

Influence values are found in attractive neighbourhoods or places with easy access to schools, parks, retail centres, and other facilities. The proximity of a property to services such as hospitals, supermarkets, and public transportation can also influence its value. For many consumers, neighbourhood safety is a vital factor to consider. Typically, the value of homes in locations with lower crime rates is greater. A property's value can be significantly impacted by noise pollution from traffic, industrial operations, and other factors. The value of a property can also be affected by environmental variables such as air quality and proximity to green space. The arrangement of a neighbourhood’s streets, sidewalks, and public areas can affect its desirability and, consequently, its property prices.

Selected Neighbourhood Variables
Accessibility
Services & Social Infrastructur**e**
Public Realm
Urban Quality

Table 7 Selected Neighbourhood-Related Variables

3.5 MALCZEWSKI FRAMEWORK

Malczewski (1999) defined SMCA as *"a process that combines and transforms geographical data (input) into a resultant decision (output)" (p.90).* Data on both criterion values and the geographical locations of alternatives are essential to conducting SMCA.

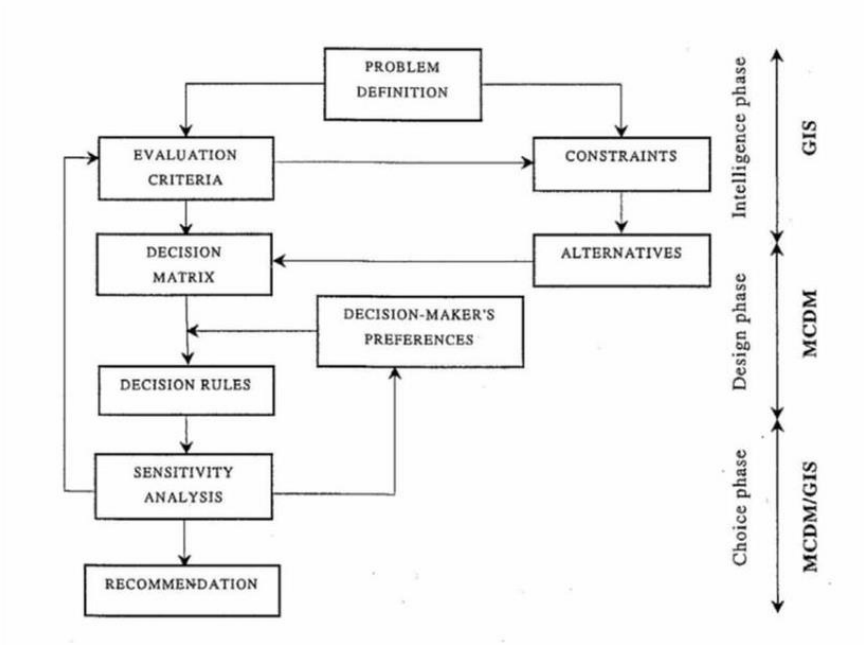


Figure 6 Malczewski framework of SMCA (Malczewski, 1999)

Malczewski's (1999) SMCA framework is based on Simon's (1960) decision-making process model, which includes the phases of intelligence, design, and choice. It combines the essential elements of GIS and MCDA through a series of specified steps such as problem definition, evaluation criteria, criterion weights, outcome determination based on decision rules, sensitivity analysis, and recommendation. The first step in the SMCA process is defining the "decision problem," which involves identifying the perceived difference between a system's desired and existing states. This step aligns with the intelligence phase of decision-making and relies on data collection and processing to gather information for identifying opportunities or problems.

Once the decision problem is defined, the next step is establishing the evaluation criteria. Two approaches can be used: specifying a comprehensive set of objectives that address all relevant concerns (constraints) or defining measures (attributes) for achieving those objectives (alternatives). These evaluation criteria are represented as criterion maps, including evaluation criterion maps and constraint maps. GIS plays a crucial role in handling and analysing the data to generate SMCA inputs. Auditing the decision makers' preferences for the evaluation criteria is essential. This step involves expressing the relative preferences as weights that indicate the importance of each criterion. Decision rules are considered to determine the best way to rank the alternatives or attributes based on these preferences.

After evaluating the decision makers' preferences, the GIS-based criterion or constraint maps and judgments need to be integrated. The alternatives should be assessed as a whole, and a decision outcome or criterion outcome is determined based on decision rules that guide the ranking process. Sensitivity analysis is conducted to verify the robustness of the output from previous steps. It involves assessing how changes in the inputs affect the ranking of alternatives. If the input changes significantly influence the ranking, it indicates a lack of robustness. The final step is making a recommendation. The ranking of alternatives and the

sensitivity analysis results are crucial factors in determining the recommendation. This step involves describing one or multiple alternatives and visualizing them to provide helpful information for decision-making.

3.6 FRAMEWORKS TO ASSESS THE URBAN QUALITY

Before introducing the applied framework, the work of Sciacchitano (2017) should be mentioned along with the Integrated Evaluation Framework developed by (Oppio et al., 2020). Sciacchitano (2017), in the thesis titled, *"How to assess urban quality: a spatial multicriteria decision analysis approach*". Sciacchitano (2017) applied this framework in the context of Milan, Italy, and it can view as a valuable piece of research in the context of this research's aims and objectives. Introducing an SMCA approach is an attempt to create a structure of analysis which provides a framework investigation into urban quality. Much like Malczewski. In addition, Sciacchitano seeks to introduce phasing, which complements how analysis of the urban environment is performed. Sciacchitano builds upon the work of Simon (1960) & Malczewski (1999), in which the decision-making process is based on four phases - intelligence, design, choice, and review, as illustrated in Fig 7.

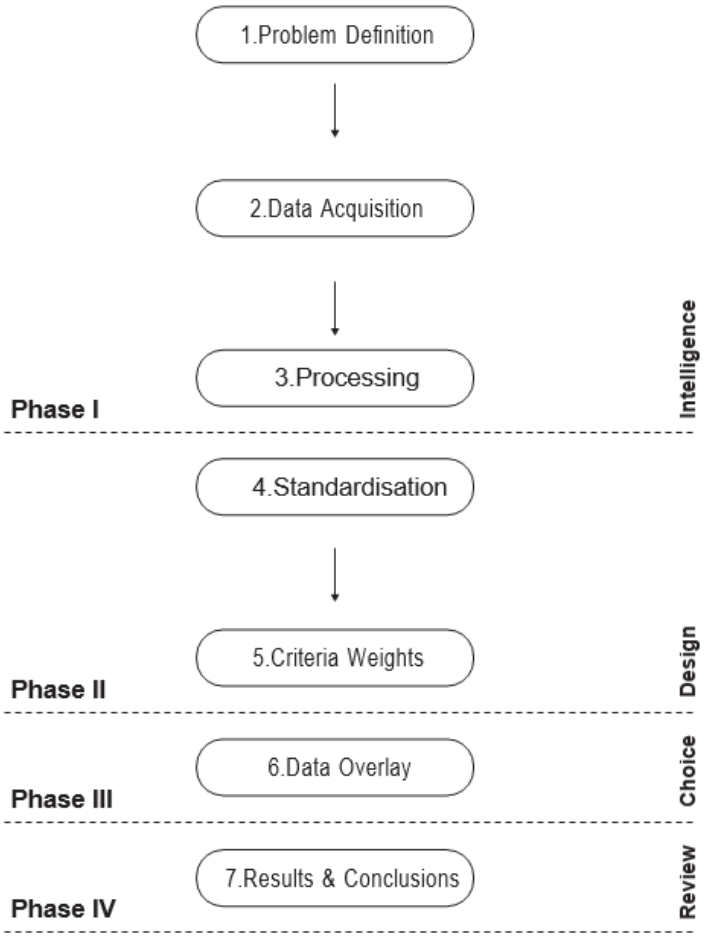


Figure 7 Framework of SMCA (Sciacchitano, 2017)

The integrated evaluation framework designed by (Oppio et al., 2020) is illustrated in Fig 8. The framework implements the previous framework and delves deeper into the research methodologies. The framework is separated into two primary sections, each serving a distinct purpose.

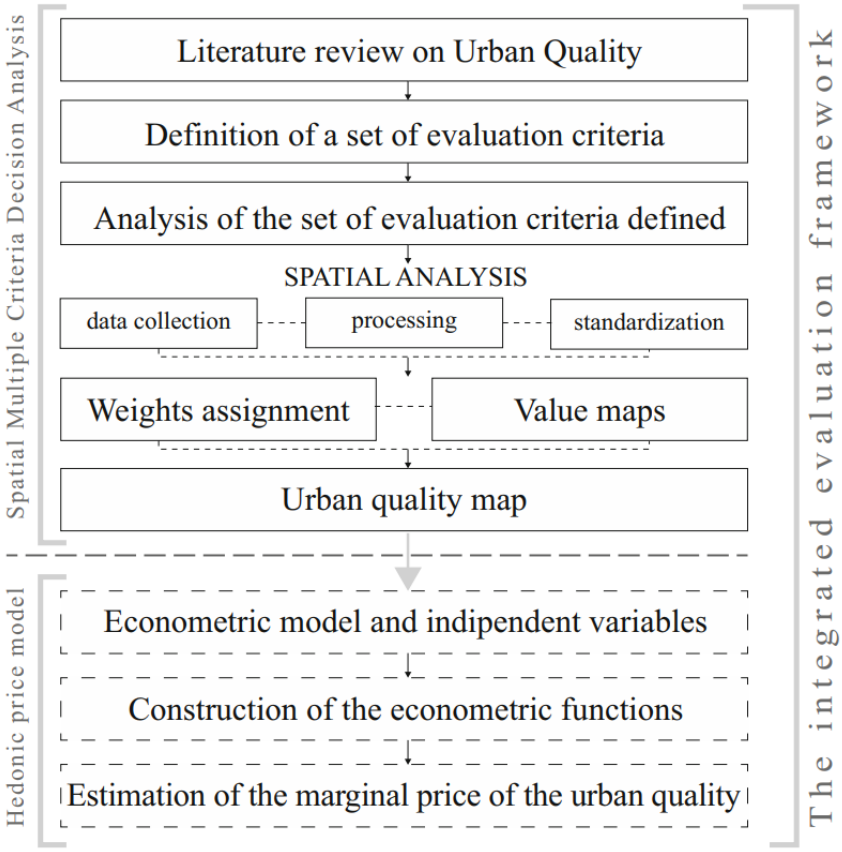


Figure 8 Integrated Evaluation Framework (Oppio et al., 2020, p.3)

The first section focuses on assessing the quality of open spaces. It involves a Spatial Multiple Criteria Decision Analysis (MCDA). This approach combines spatial data from Geographical Information Systems (GIS) with decision-makers preferences to generate value maps. These value maps help evaluate the spatial elements related to open spaces.

In the second section, an econometric model is developed to estimate the marginal price of urban quality. This model aims to quantify the economic value associated with the quality of urban spaces. By utilising economic principles and statistical analysis, the model provides insights into the monetary impact of urban quality on property prices or other relevant economic indicators.

Overall, this integrated framework introduced by Oppio et al. (2020) allows for a comprehensive evaluation of the quality of open spaces by combining spatial analysis techniques and economic modelling. Furthermore, it enables researchers and decision-makers to assess the spatial elements using MCDA and understand the economic implications of urban quality through the econometric model.

The applied methodology and its application is detailed in Chapter 4.3 Multi-Methodological Evaluation Framework & Chapter 4.4 Application of The Multi-Methodological Framework.

4 CHAPTER 4: DUBLIN, IRELAND – CASE STUDY

4.1 STUDY AREA

4.1.1 Dublin City Council (DCC)

Dublin City Council (DCC) is the authority responsible for local government in Dublin City and is the subject study area of this investigation. The council is responsible for public housing and community, roads and transportation, urban planning and development, amenity, culture, and environment. The council has 63 elected members and is the largest local council in Ireland. Dublin is the capital of Ireland. The housing market in Dublin is undoubtedly the biggest in Ireland. One reason may be the size of the conurbation, which –the capital of Ireland – is the city with the largest population in Ireland. Moreover, not only is Dublin the heart of political activity, but it is also the centre of economic, cultural, and scientific life.

In June 2022, the Central Statistics Office (CSO) published preliminary population statics for Ireland. The number of inhabitants was estimated to be 592,713 (a 7% increase on the previous census conducted in 2016). The area of the DCC extends to 115 km2 (DCC, 2023), giving a population density of 5,153 inhabitants per square kilometre. For comparative and illustrative purposes, the Comune di Milano has a population of 1,371,498 (iStat, 2022) within an area of 182 km2 (Comune di Milano, n.d); therefore, the population has a population density of 7,536 inhabitants per square kilometre.

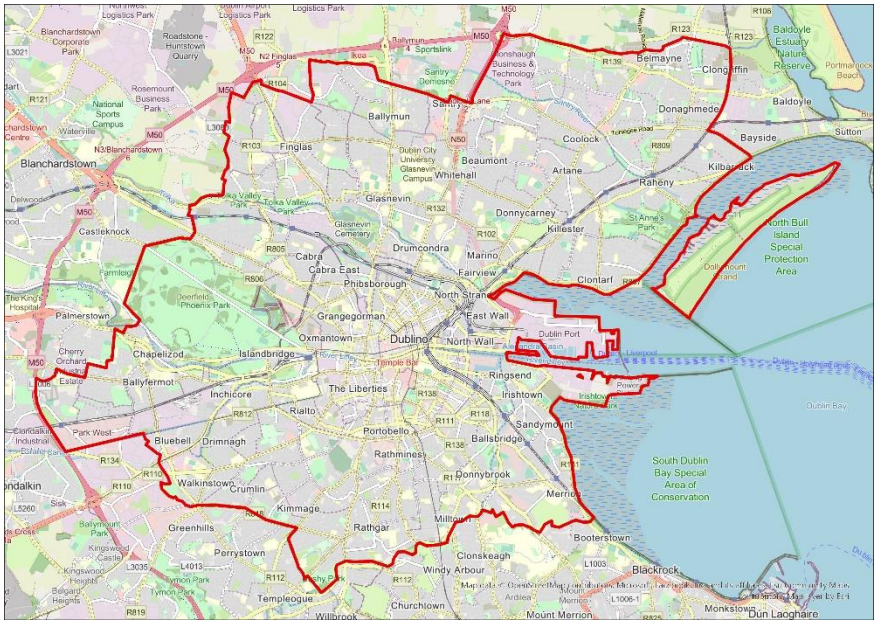


Figure 9 Study Area - Dublin City Council

The complex spatial configuration of Dublin City, examining its diverse mix of historical, residential, commercial, and recreational areas. Through a comprehensive analysis of the city centre, historic quarters, residential neighbourhoods, suburban expansion, parks and open spaces, industrial and business districts, and transport infrastructure, this study provides valuable insights into Dublin's urban diversity. By understanding the spatial arrangement of the city, policymakers, urban planners, and researchers can gain a deeper appreciation of Dublin's unique urban fabric and make informed decisions regarding future development and preservation efforts.

Dublin City is Ireland's capital and cultural heart, renowned for its historical heritage, vibrant urban atmosphere, and diverse social fabric. Understanding the spatial configuration of the city is crucial for comprehending its urban diversity and the factors that have shaped its development over time.

The city centre serves as the focal point of Dublin, comprising a range of commercial, cultural, and historical sites. Notable areas include O'Connell Street, Temple Bar, and Grafton Street, which attract diverse activities such as shopping, entertainment, and the arts. The city centre's spatial configuration reflects its role as a vibrant cosmopolitan hub, drawing residents, visitors, and businesses from various backgrounds.

Figure 10 O'Connell Street - Dublin's Main Thoroughfare

Dublin's historic quarters, such as Temple Bar, Smithfield, and The Liberties, provide a glimpse into the city's rich past while contributing to its unique character. These areas blend historic charm with modern development, attracting tourists and locals through traditional pubs, artistic scenes, and repurposed industrial buildings. Preserving and revitalizing these historic quarters is essential for maintaining Dublin's cultural identity.

Figure 11 Temple Bar

Dublin features various key urban centres and residential neighbourhoods surrounding the city centre, each with distinct architectural styles, community dynamics, and socioeconomic characteristics. Areas like Rathmines, Phibsborough, Ranelagh, and Drumcondra offer various housing options, including Georgian and Victorian houses, apartments, and green spaces. These neighbourhoods foster social cohesion and contribute to Dublin's urban diversity.

Dublin has experienced a significant suburban expansion in recent decades to accommodate its growing population. As a result, suburbs such as Coolock, Kimmage, Marino have witnessed considerable residential and commercial development. This expansion helps alleviate pressure on the city centre, offers a balanced population distribution, and contributes to Dublin's social and economic diversity.

Figure 12 Mario - An example of the Garden City in North Dublin City

Dublin's abundance of parks and open spaces play a vital role in enhancing its residents' and visitors' quality of life. Iconic parks like Phoenix Park, St. Stephen's Green, and Merrion Square provide essential recreational areas, contribute to environmental sustainability, and offer respite from urban life. In addition, these green spaces are essential to Dublin's spatial configuration and contribute to its urban diversity.

Figure 13 Merrion Square - An example of a rectangular Georgian Square

Dublin's industrial and business districts, such as the Docklands and Sandyford Business Park, significantly drive the city's economic growth and innovation. The Docklands, a prime example of successful regeneration, has become a bustling hub for business, technology, and residential developments. In addition, these districts offer employment opportunities, foster entrepreneurship, and contribute to Dublin's economic and cultural diversity.

Figure 14 Grand Canal Dock - The focal square of the Dockland regeneration

4.1.2 Demographic Analysis using Location Quotient

To better appreciate the background of the study area under investigation, demographic analysis has been implemented. It is essential to investigate the dynamics of these urban neighbourhoods and their borders. Considering this, the analysis touches both the municipal and census levels, so enhancing the study. The location quotient is an extremely useful tool for quantifying how a particular group is represented in a small unit over a bigger geographical area. Location quotient is a basic yet effective tool to quantify how a selected group is represented in a local unit over a larger geographical area. In this research, it is used to examine the concentration of ethnicity, level of education in two forms and unemployment. It must be noted that these location quotients are using statistics from the Central Statistics Office (CSO) dated 2016 at the last national census. This data for each of the Location Quotient's was created using Census 2016 data produced by the Central Statistics Office (CSO) and Electoral Divisions national boundary data (generalised to 20m) produced by Ordnance Survey Ireland (OSi).

$$Lq = ((x\_i))/((y\_i)(X/Y)$$

To elaborate:

x_i is the number of people living in the electoral division and belonging to the group y,
y_i is the total number of people living in the electoral division
X is the number of people belonging to the group x living in the DCC Area
Y is the total population of the DCC Area

There are three possible scenarios:

–LQ is equal to 1, and this means that the share of the two groups is the same.
–LQ is < 1, the group is underrepresented in the local unit.
–LQ is > 1, the group is overrepresented in the local unit in relation to a larger unit (the city).

4.1.2.1 LQ Ethnicity / Cultural Background

The source layer represents Census 2016 'Usually Resident Population by Ethnic or Cultural Background', for Ireland, 2016, at Electoral Division level. The LQ for Ethnicity / Cultural Background is based on the ethic white Irish resigning in an electoral division area.

LQ Ethnicity = LQ Ethnicity = (T2_1WI_electoral_division/T2_2T_ electoral_division)/ (T2_1WI_dublin_city_council_total/ T2_2T _dublin_city_council_total)

T2_1WI_electoral_division = Total number of white Irish residents in the electoral division
T2_2T_ electoral_division = Total number of residents in the electoral division

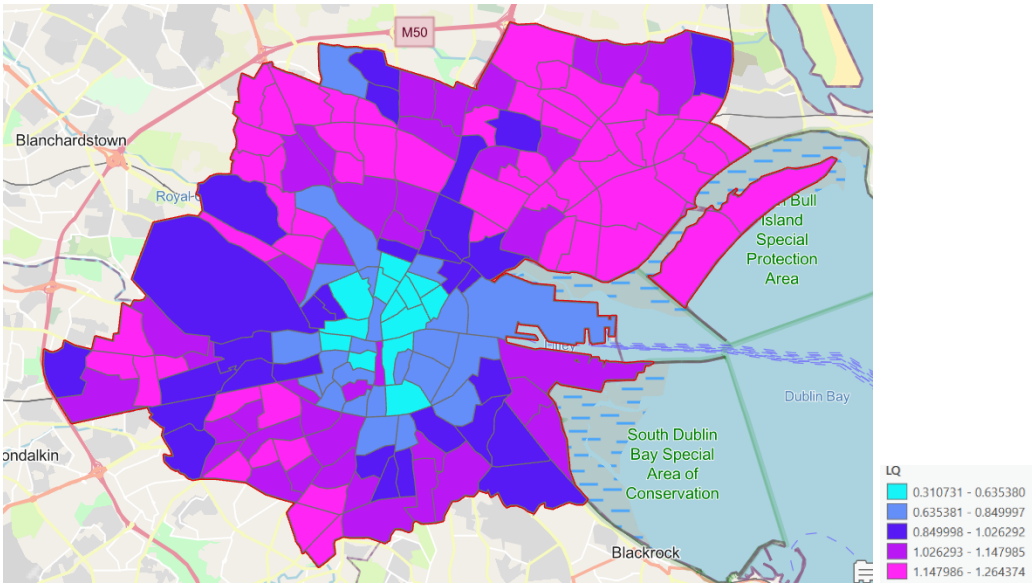


Figure 15 LQ Ethnicity / Cultural Background

This LQ Ethnicity / Cultural Background illustrates the ethnic makeup of Dublin. Here it can be seen that the city's suburban areas are predominantly made up of "white Irish" residents. In contrast, the city centre is much more multicultural in respect of the overall ethnic and cultural configuration of the city.

4.1.2.2 LQ Highest Level of Education

The source layer represents Census 2016 Theme 10.4, 'Population Aged 15+ by Sex and Highest Level of Education Completed', for Ireland, 2016, at Electoral Division level. The LQ for Level of Education is based on the number of residents with honours bachelor's degree, professional qualification or both within the electoral division area.

LQ Highest Level of Education = (T10_4_HDPQT_electoral_division/ T10_4_TT_ electoral_division)/ (T10_4_HDPQT_dublin_city_council_total/ T10_4_TT_dublin_city_council_total)

T10_4_HDPQT_electoral_division = Total number of residents with honours bachelor's degree, professional qualification, or both in the electoral division
T10_4_TT_electoral_division = Total number of residents in the electoral division

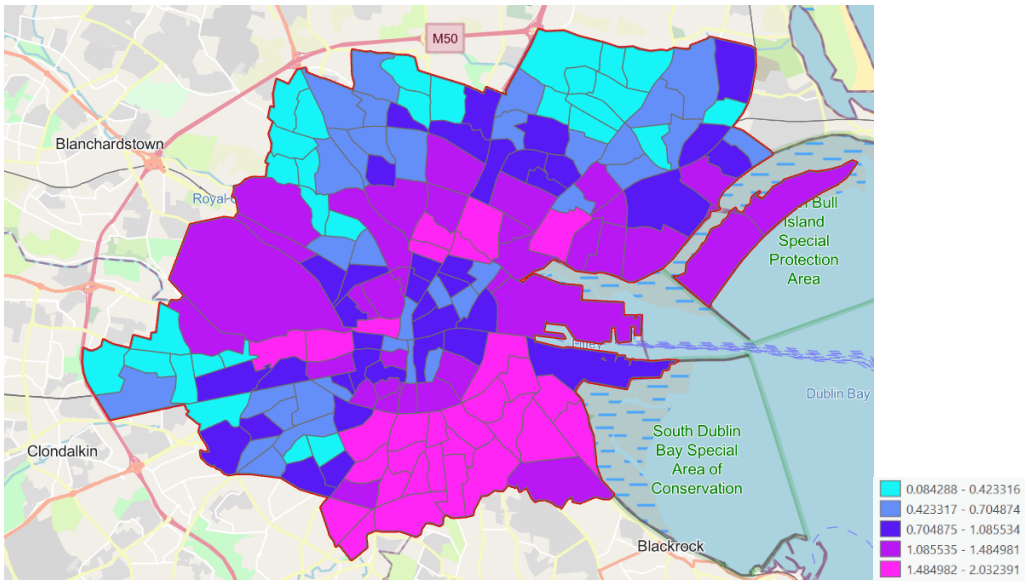


Figure 16 LQ Highest Level of Education

This LQ Highest Level of Education illustrates the educational levels within the study area. Here it can be seen that the southeastern and northeastern suburban areas are predominantly made up of those with an "honours bachelor's degree". In contrast, akin to the previous LQ, the city centre needs to be more educated. While the suburbs in the North and South-West or the peripheral areas of the study area have significantly lower levels of education in the context of the study area. A spatial configuration and pattern begin to emerge in the study area.

4.1.2.3 LQ Unemployment

This feature layer represents Census 2016 Theme 8.1, 'Population Aged 15+ by Principal Economic Status and Sex', for Ireland, 2016, at Electoral Division level. The LQ for Unemployment is based on the number of residents unemployed have lost or given up previous job within the electoral division area.

LQ Unskilled = (T8_1_ULG_2_electoral_division/ T8_1_TT_ electoral_division)/ (T8_1_ULG_2_dublin_city_council_total/ T8_1_TT_dublin_city_council_total)

T8_1_ULG_2_electoral_division = Total number of residents who unemployed have lost or given up previous job in the electoral division
T8_1_TT_electoral_division = Total number of residents in the electoral division

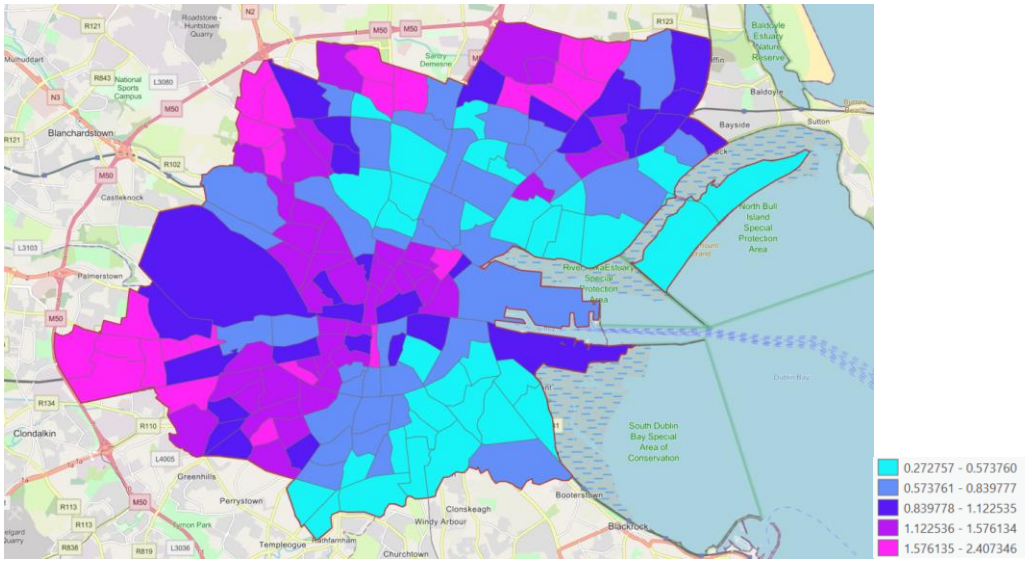


Figure 17 LQ Unemployment

The final LQ deals with unemployment. It must be noted that the data informing the LQ is taken from the 2016 census, which is dated in the context of now. It is clear that Electoral Divisions with a strong LQ in the Highest Level of Education are more resilient in maintaining employment. Although, it is also clear that areas in the North of the study also have a low percentage of unemployment at the time of the census.

4.2 THE RESIDENTIAL REAL ESTATE

4.2.1 Ireland: Overview

From 1981 to 2019, the Irish housing market underwent significant change. This is especially evident since the "Celtic tiger" emerged in the mid-1990s (Egan et al., 2022). The housing market as it exists today is still profoundly influenced by the 2008 Global Financial Crisis and the subsequent slowdown in economic growth and housing supply. Egan et al. (2022) state that the Irish property boom was the largest across OECD countries between 1995 and 2007, with average annual housing price increases of 9%. Over the period 2005 – 2007, a yearly average of almost 85,000 units were built. However, after the Global Financial Crisis, housing construction levels collapsed, and by 2013 just over 8,000 new dwellings were being built, and according to the CSO, in 2022, there were 29,851 new dwelling completions, the highest since 2007. Paint this against cumulative population growth of over 10% since 2013, illustrating an apparent absence of supply.

The CSO's Residential Property Price Index as of January 2023 illustrates this point. As of January 2023, the national index has reached 167.7, 2.5% higher than its peak in April 2007 at the height of the property boom. The residential property prices in Dublin are 7.3% lower than in February 2007, while those in the rest of Ireland are 2.4% higher than in May 2007. National property prices have increased by 128.5% since their low point in early 2013. Residential property prices in Dublin have increased by 129.6% since their low point in February 2012, while those in the remainder of Ireland have increased by 135.7% since their low point in May 2013.

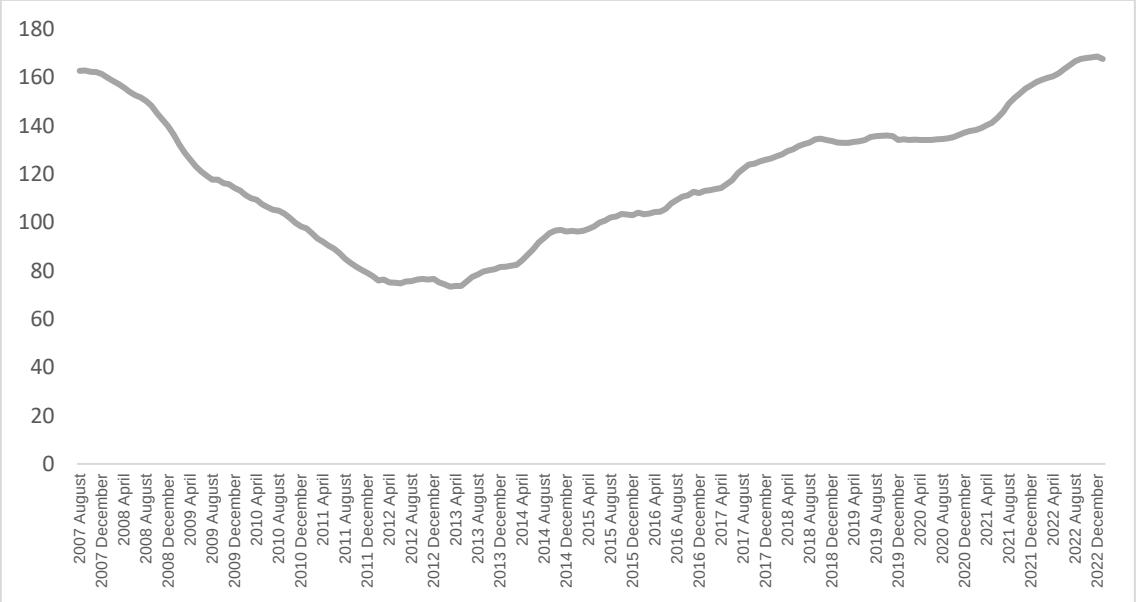


Figure 18 CSO's Residential Property Price Index (Authors Elaboration)

4.2.2 Dublin: Overview

The Dublin housing market is one of the most dynamic and complex in Ireland, and it has been experiencing significant changes in recent years. Historically, the Dublin housing market has been characterized by a cycle of boom and bust, with a sharp increase in house prices followed by a sudden decline in the aftermath of the 2008 global financial crisis. Since then, the market has experienced a recovery period, with house prices rising steadily in Dublin since around 2013.

One of the main drivers of the housing market in Dublin is the high demand for housing in the city due to its status as Ireland's economic and cultural center. This demand has been driven

by a combination of factors such as a growing population, inward migration, and an increase in highly skilled jobs in the city. However, this high demand has also led to a shortage of housing supply, which has contributed to rising house prices.

According to the Q4 2022 Daft Housing Report, 2022 prices increased by 5.0%, while in 2021, prices rose by 3.4% in the city. Moreover, this two-way split, of course, hides much detail. Within Dublin, certain postcodes – Dublin 6 and Dublin 15 saw strong growth during the year, with prices rising 9.6% and 6.9%, respectively, in these postal districts. Meanwhile, prices fell by 5% in Dublin 17 and grew by 3% or less in Dublin 10, Dublin 20 and Dublin 22. If this looks like a simple story of more expensive areas seeing greater price growth, then an increase of just 1.4% in Dublin 4 – and 3.3% in South County Dublin. The Daft report states that the number of transactions in Dublin in the year to September 2022 was 17,842, a 3% increase on the same period in 2021.

Area	Median Price (€)	YoY Change
North City	390,723	5.2%
City Centre	368,485	4.1%
South City	465,401	4.3%

Table 8 Residential Property Prices in Dublin Areas (Daft, 2022)

For statistical purposes, the report has broken our study area into three areas, north city, city centre and south city. The housing market in the three areas is quite different. From Q1 2018 to Q4 2022, South Dublin City has the greatest median price at €428,251 and a percentage growth over that period of 15%. North Dublin City's median price stands at €357,563 period and has experienced growth of 16.7% over the same time. The area with the lowest median price of €343,46 and lowest growth of 13.1% over the period in Dublin City Centre.

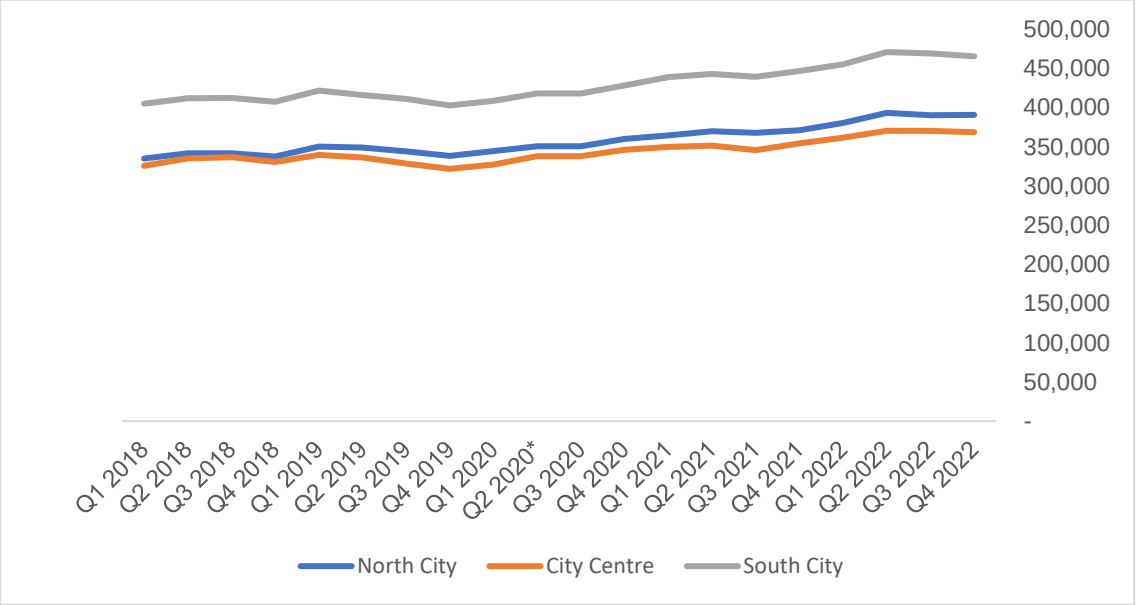


Figure 19 Residential Property Prices in Dublin (Daft, 2022)

4.3 MULTI-METHODOLOGICAL EVALUATION FRAMEWORK

The framework adopted in this research combines those mentioned in Chapter 3, leaning more on the framework proposed and adopted by Oppio et al. (2020) as it is a purpose-built theory for an integrated/mixed methodological approach to investigating urban quality. While our research aim is much the same, the research diverges to investigate urban quality-related effects on residential property prices. The methodology implied will have one critical additional step of valuation, which implements the hedonic pricing model. Including the hedonic pricing model is a fundamental step in determining the effects of urban quality on residential property prices.

The research methodology employed in this study adopts a mixed-methodological approach to investigate the relationship between urban quality and residential property prices. Building upon the framework proposed by Oppio et al. (2020), the methodology incorporates an additional step of valuation using the hedonic pricing model to assess the impact of urban quality on property prices. Notably, the methodology has been updated to incorporate advancements in software since the Oppio framework was established in 2020. The implemented methodology follows a two-phase multi-methodological approach, as illustrated in Fig 20. In Phase 1, a Spatial Multi-Criteria Analysis (SMCA) is developed and executed, comprising six stages ranging from problem definition to data overlay. This phase involves conducting a comprehensive literature review, refining the research question, sourcing relevant data, and processing and analysing the collected data. ArcGIS Pro is extensively used in this Phase, along with Visual Studio Code for the purposes of web scraping. Phase 2 focuses on valuation through econometric modelling, consisting of three stages: preparation for valuation, actual hedonic pricing model and review. This phase utilises the data acquired and processed in Phase 1 and employs SPSS (a statistical software suite developed by IBM) to conduct a hedonic pricing model. Finally, the review entails reviewing the outcomes of Phase 2. This phase addresses the research question and provides insights into the examined field's implications, relevance for experts, and decision-making considerations.

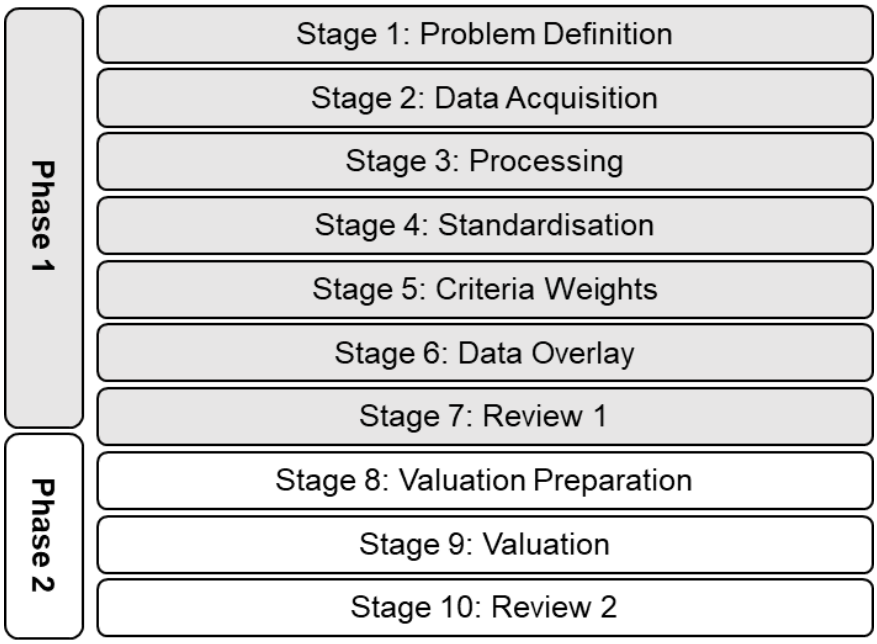


Figure 20 Applied Multi-Methodological Framework

4.4 APPLICATION OF THE MULTI-METHODOLOGICAL FRAMEWORK

4.5 PHASE 1: SPATIAL MULTI-CRITERIA ANALYSIS (SMCA)

4.5.1 Stage 1: Problem Definition

The initial Stage of this study involves clearly defining the problem and evaluating the significance of addressing the specific argument within its defined application boundary. To gain a comprehensive understanding of the implications associated with urban quality, a thorough literature review is conducted to examine how the issue has been previously addressed. This literature should examine how urban quality is defined, how urban quality is managed in the study area, and the relationship urban quality has on residential property prices. This analysis will also entail establishing the characteristics of urban quality, which will be imperative for the research aim while also defining urban quality. Throughout this stage, emphasis should be placed on utilising reliable and authoritative sources, including plans and reputable publications, to ensure the validity and credibility of the research. The first result of the framework is Fig 22. It provides a platform for the forthcoming Phases and Stages to be conducted.

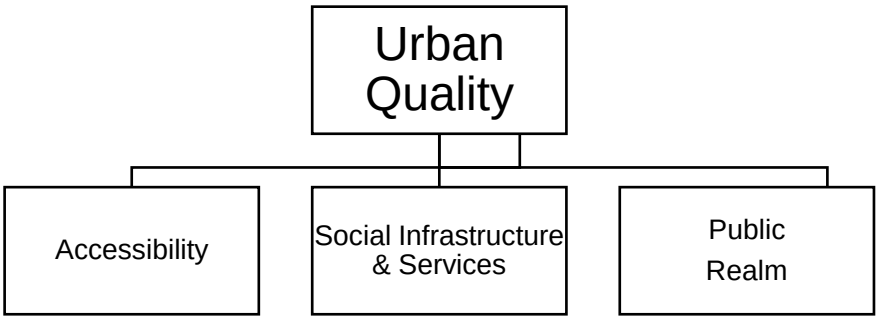


Figure 21 Problem Definition Diagram

4.5.2 Stage 2: Data Acquisition

Collecting data is essentially data acquisition. The investigation's level of detail and purpose determine the methods used for gathering information. There are two critical datasets required to deliver upon the research aim. The first is regarding data relating to urban quality. These will be defined in Stage 1 and should be in vector or raster format, allowing them to be legible in ArcGIS Pro and processable in the software in the next stage. The second dataset is related to residential property observations and integral to Phase 2, which can be more cumbersome to acquire depending on the publicly available information. In the case the information is not publicly available, other means, such as web scraping using Python, could be considered.

There are different data sources, such as personal elaborations, data entry processes, or external databases. When using external databases, it is essential to carefully select the source of information to ensure that the data is up-to-date, clear, and accurate.

Data sources are often very diverse, but fortunately, in the case of Phase 1, much of the data required to complete this investigation is publicly available through data.gov.ie, while some other data comes from Open Street Map and Google Maps through direct observation. The below table gives the reader a detailed explanation of the source of each dataset. As mentioned previously, data is in vector format, composed of point, line, and polygonal shapefiles. While the data for Phase 2 was acquired through sources known to the author and with the permission of the copyright holder.

No	Attribute	Category	File Type	Published by	Link
1	Dublin Bus Stops	Accessibility	Point	National Transportation Authority	https://hub.arcgis.com/maps/ielocal::dublin-bus-stops
2	Luas (Light rail) Stops	Accessibility	Point	Transport Infrastructure Ireland	https://data.gov.ie/dataset/luas-stop-locations?package_type=dataset
3	Irish Rail Stations	Accessibility	Point	Ordnance Survey Ireland	https://data.gov.ie/dataset/railway-stations-osi-national-250k-map-of-ireland5
4	Dublin Bike Stations	Accessibility	Point	Dublin City Council	https://data.gov.ie/dataset/dublinbikes-api
5	Cycle Lanes	Accessibility	Polygon	National Transportation Authority	https://data.gov.ie/dataset/greater-dublin-area-cycle-infrastructure-nta?package_type=dataset
6	Childcare	Services & Social Infrastructure	Point	Pobal	https://maps.pobal.ie/WebApps/ChildcareFacilities/index.html
7	Primary Schools	Services & Social Infrastructure	Point	Department of Education and Skills	https://data.gov.ie/dataset/schools-in-dublin-region?package_type=dataset
8	Post-Primary Schools	Services & Social Infrastructure	Point	Department of Education and Skills	https://data.gov.ie/dataset/schools-in-dublin-region?package_type=dataset
9	Special Schools	Services & Social Infrastructure	Point	Department of Education and Skills	https://data.gov.ie/dataset/schools-in-dublin-region?package_type=dataset
10	Libraries	Services & Social Infrastructure	Point	Dublin City Council	https://data.gov.ie/dataset/dublin-city-libraries-accessibility-audit?package_type=dataset
11	Public Toilets	Services & Social Infrastructure	Point	Dublin City Council	https://data.gov.ie/dataset/public-toilets-dcc?package_type=dataset
12	Pharmacies	Services & Social Infrastructure	Point	Health Service Executive	https://data.gov.ie/dataset/list-of-pharmacies-in-ireland?package_type=dataset
13	Doctors	Services & Social Infrastructure	Point	Health Service Executive	https://data.gov.ie/dataset/family-practice-gp-sites?package_type=dataset
14	Health Centres	Services & Social Infrastructure	Point	Health Service Executive	https://data.gov.ie/dataset/family-practice-gp-sites?package_type=dataset
15	Nursing Homes	Services & Social Infrastructure	Point	Health Service Executive	https://data.gov.ie/dataset/list-of-nursing-homes-in-ireland?package_type=dataset
16	Hospitals	Services & Social Infrastructure	Point	Health Service Executive	https://data.gov.ie/dataset/list-of-hospitals-in-ireland
17	Sports Facilities	Services & Social Infrastructure	Point	Sports Ireland	https://www.sportireland.ie/outdoors/national-database-of-sport-recreation-amenities
18	Museums	Services & Social Infrastructure	Point	Heritage Council	https://data.gov.ie/dataset/7b295fd9-bf68-410b-94ae-2ff7a89ead84/resource/070b1937-1143-4b3f-98f8-fa0eeae3534c
19	Air Quality	Public Realm	Polygon	Dublin City Council & Google	https://data.gov.ie/dataset/google-airview-data-dublin-city
20	Coastline	Public Realm	Line	Ordnance Survey Ireland	https://data.gov.ie/dataset/shoreline-coastline?package_type=dataset
21	Architectural Conservation Area	Public Realm	Polygon	Dublin City Council	https://data.gov.ie/dataset/dcc-development-plan-2016-2022?package_type=dataset
22	Derelict & Vacant Sites	Public Realm	Point	Dublin City Council	https://www.dublincity.ie/residential/planning/active-land-management
23	Sites & Monuments Record (SMR)	Public Realm	Point	Department of Housing, Local Government, and Heritage	https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland
24	Nation Inventory of Architectural Heritage (NIAH)	Public Realm	Point	Department of Housing, Local Government, and Heritage	https://data.gov.ie/dataset/national-inventory-of-architectural-heritage-niah-national-dataset?package_type=dataset
25	Public Lighting	Public Realm	Point	Dublin City Council	https://data.gov.ie/dataset/street-lighting-dublin-city?package_type=dataset
26	Trees	Public Realm	Point	Dublin City Council & University College Dublin	https://mappinggreendublin.com/curio/
27	Seats & Beaches	Public Realm	Point	Open Street Map	N/a
28	Public Green Space	Public Realm	Polygon	Dublin City Council	https://data.gov.ie/dataset/parks-and-open-spaces-dcc
29	Public Allotments	Public Realm	Polygon	Dublin City Council	https://www.dublincity.ie/residential/improving-my-community/allotments-and-community-gardens
30	Noise	Public Realm	Polygon	Environmental Protection Agency	https://gis.epa.ie/EPAMaps/

4.5.3 Stage 3: Processing

During the processing stage of this investigation, a suitable software program that integrates Geographic Information Systems (GIS) is employed, specifically ArcGIS Pro. This software offers a range of geoprocessing tools within the "Spatial Analyst Toolbox," enabling the efficient execution of the analysis.

To begin, the geographical extent of the model is defined, ensuring a well-defined scope for the study. Subsequently, the data acquired in Stage 2 is introduced into the analysis. Raw data collected from diverse sources are thoroughly organised within the model, following a predetermined and structured framework. This data is refined and transformed into point, polygon, or line formats. In order to maintain the integrity of the model, it is essential to ensure that the acquired data aligns with the defined extent and does not spill over.

Additionally, efforts are made to standardise the data by implementing common symbology, promoting consistency and ease of interpretation.

Furthermore, appropriate cell dimensions are assigned to represent the spatial attributes of the model accurately. With these considerations in place, a basic model is constructed. This visual representation serves as a foundation for the subsequent stages of analysis and facilitates a comprehensive understanding of the study area. The outcome should resemble Fig 22**.**

Figure 22 Introduction of Point data into ArcGIS Pro model

The next step in this stage is to elaborate each using the Distance Accumulation tool in ArcGIS Pro. Having superseded the Euclidean Distance tool, it measures the accumulated distance from each cell or location to a set of input features or a specified starting point. The tool considers the distance values associated with each cell or location and calculates the cumulative sum of distances as it moves away from the starting point as illustrated below in Formula.

$$d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$$

Where $(x_2 - x_1)$ are the geographical coordinates of one point, $(y_2 - y_1)$ are the geographical coordinates of the other point and d is the distance between $(x_2 - x_1)$ and $(y_2 - y_1)$.

At this point, the file structure changes here from vector to raster. Again, there is a need to determine an element of standardisation by manipulating the symbology. This operation should conduct for each dataset collected in the previous stage, and the outcome should reassemble Fig 23.

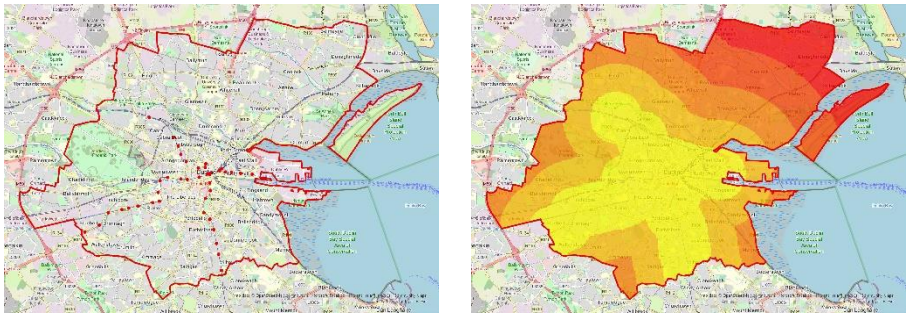


Figure 23 Application of the Distance Accumulation tool from a point shapefile

If the data in question is not conducive to the Distance Accumulation tool or it is better explained by alternative means the Point Density tool is employed in this analysis. The Point Density tool calculates the density of point features around each output raster cell. The tool was applied to both the Public Light and Tree attributes as their source data is best explore through density per square kilometre and per hectare respectively.

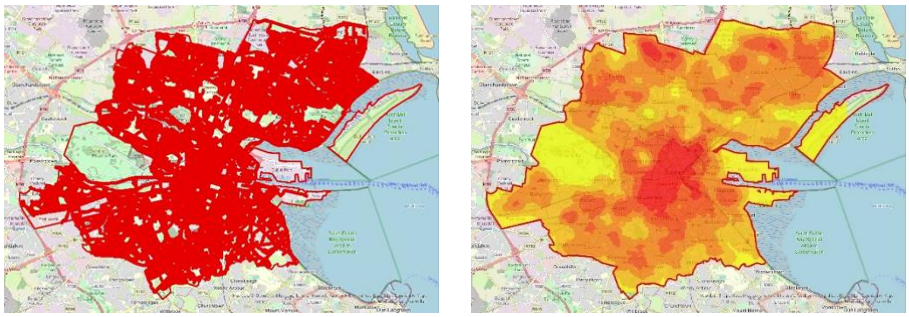


Figure 24 Application of the Point Density tool from a point shapefile

4.5.4 Stage 4: Standardisation

The distance accumulation function maps (or other processed maps) have now been created in the processing stage of Phase 1. At this point in the framework, it is essential to operate a reclassification on all distance accumulation function maps based on ten intervals, where one is the lowest assignable value and ten is the highest value. This procedure of reclassification is conducted for two key reasons. Firstly, it allows the rasterised data processed in the previous phase to be adjusted at distance intervals relative to that data source.

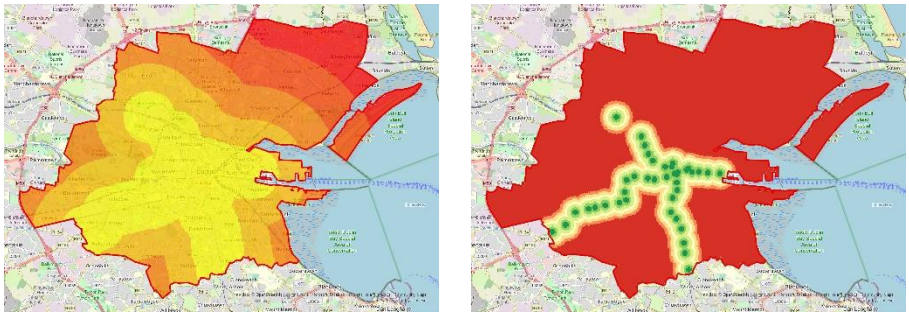


Figure 25 Application of Reclassify funtion at defined intervals

Secondly, it allows an assignable value to such distances, giving meaning or purpose to a particular distance from a source of value. A value and a colour are assigned, as illustrated below in Fig 26.

Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null

Figure 26 Assigning Value numerically supported by a visual differentiation.

The value function graph in Fig 27 represents the intervals and values associated with those intervals. These maps are raster files that assign a value to each cell. In the case illustrated in Fig 26, the intervals from 0 to 125 meters return a value of ten. After 750 metres, the source data is considered to have no utility, and the value function returns a one. This process of standardisation is repeated for each dataset, taking into consideration the uniqueness of each dataset and the value it produces over what distance.

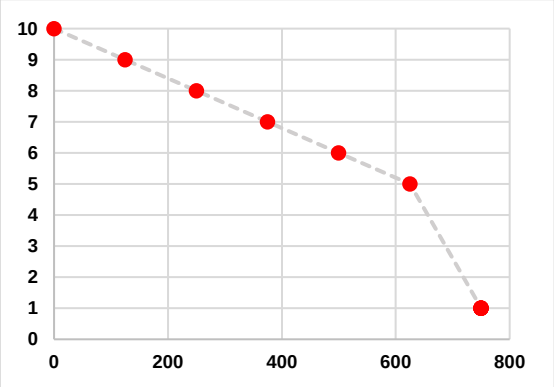


Figure 27 Function Graph

All the reclassification functions are illustrated in the sub-chapter.

4.5.4.1 Application Of Stage 3: Processing & Stage 4: Standardisation

Considering the previous Stage's explanation, the evaluation is developed for each attribute of each criterion related to urban quality. They are arranged in the following manner beginning with a description of the data source and an evaluation of the data per capita. A brief explanation of the operation, processing and standardisation process is detailed, which is supported by corresponding maps. All assumptions taken here regarding the value function are also referenced here.

Accessibility

Dublin Bus Stops DCC

Description
Dublin Bus Stops are designated locations where their services pick up and drop off patrons.

Total	2,088
Per Capita	284

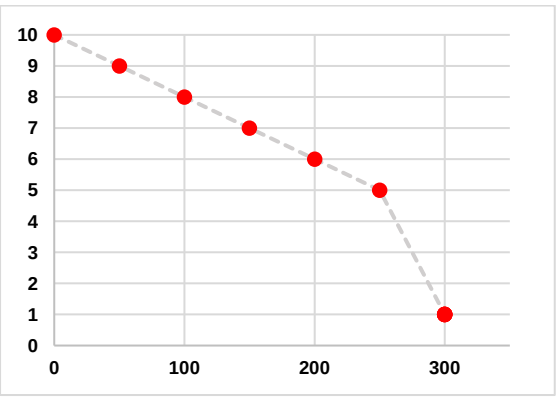
Data Source
National Transportation Authority

Operation
Selection by location within study area, export as feature class.

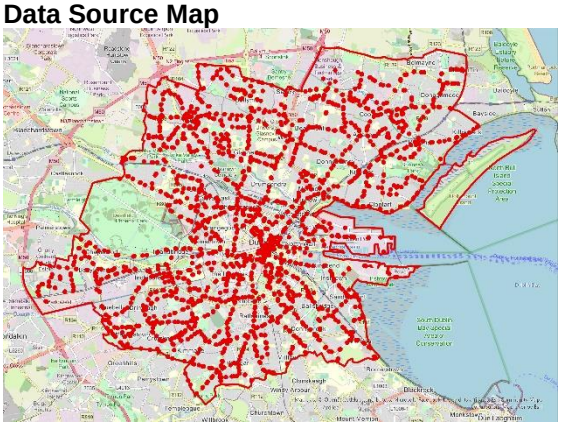
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 50 and 300m decrease gradually in five intervals every 50m. Distances >300m is standardised to 1.

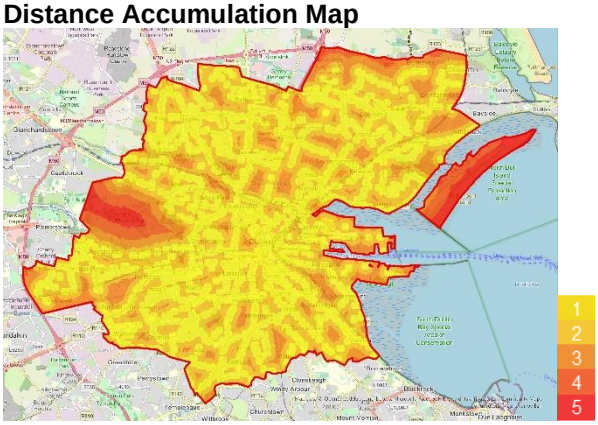
Value	Start (M)	End (M)
10	0	50
9	50	100
8	100	150
7	150	200
6	200	250
5	250	300
4	300	Extent
3	Null	Null
2	Null	Null
1	Null	Null



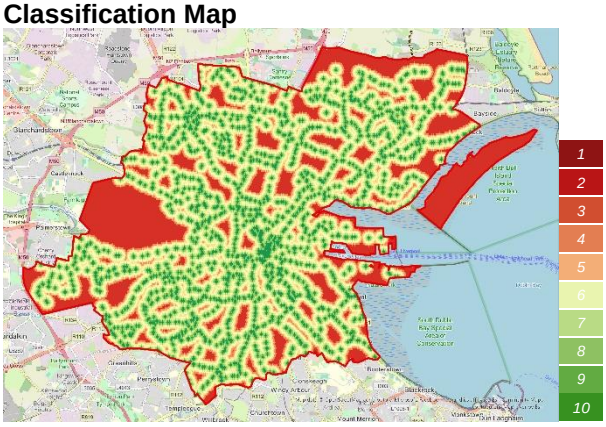
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Chartered Institution of Highways & Transportation (CIHT)

Retrieved from:
https://www.ciht.org.uk/media/4459/buses_uatp_full_version_v5.pdf

Accessibility

Luas Stops

Description
Luas (light-rail) Stops are designated locations where their services pick up and drop off patrons.

Total	40
Per Capita	14,818

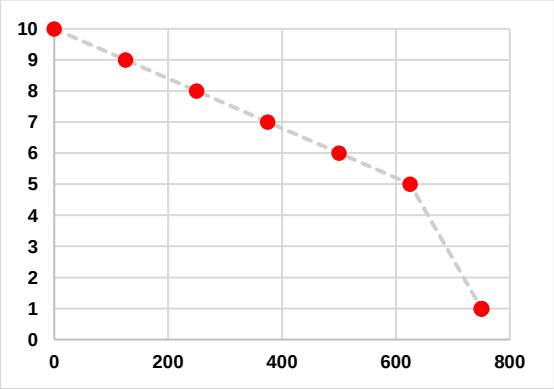
Data Source
Transport Infrastructure Ireland

Operation
Selection by location within study area, export as feature class.

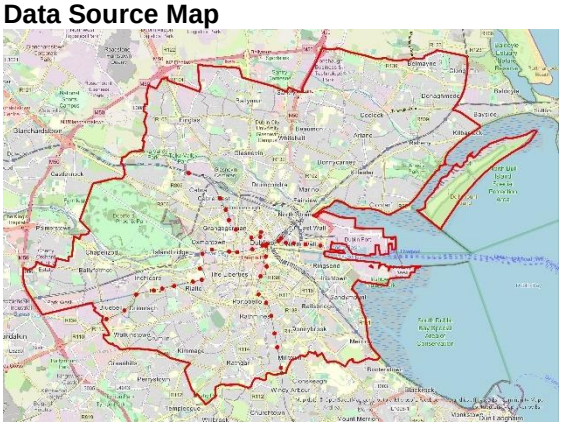
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750m decrease gradually in five intervals every 125m. Distances >750m are standardised to 1.

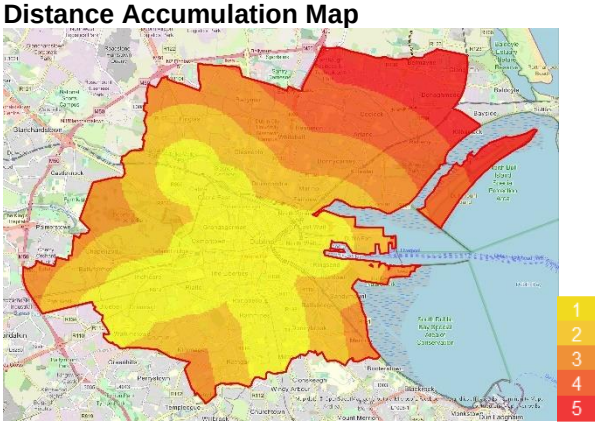
Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



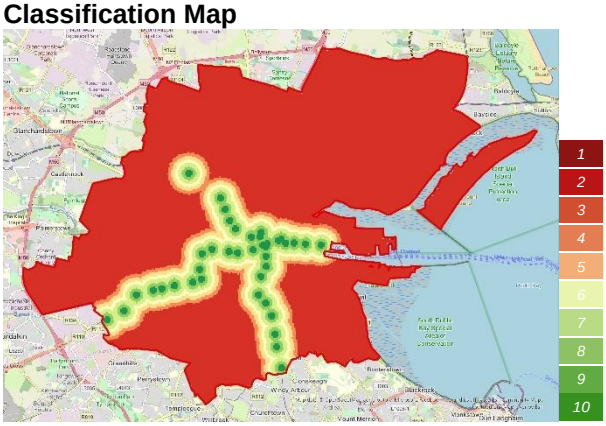
Data Source Map



Distance Accumulation Map



Classification Map



Reference
BREEAM Communities, Technical Manual

Retrieved from:
https://tools.breeam.com/bre_PrintOutput/BREEAM_Communities_0_1.pdf

Accessibility

Irish Rail Stops

Description
Irish Rail Stops are designated locations where their services pick up and drop off patrons.

Total	20
Per Capita	29,635

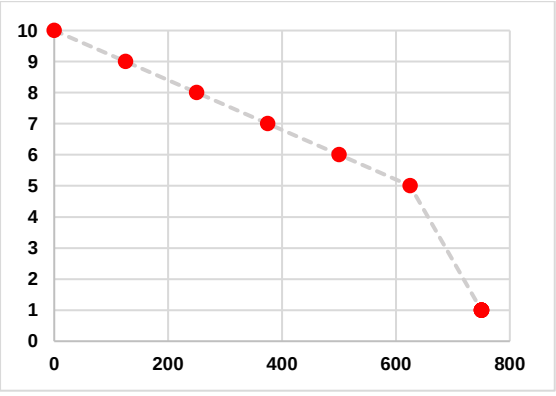
Data Source
Ordnance Survey Ireland

Operation
Selection by location within study area, export as feature class.

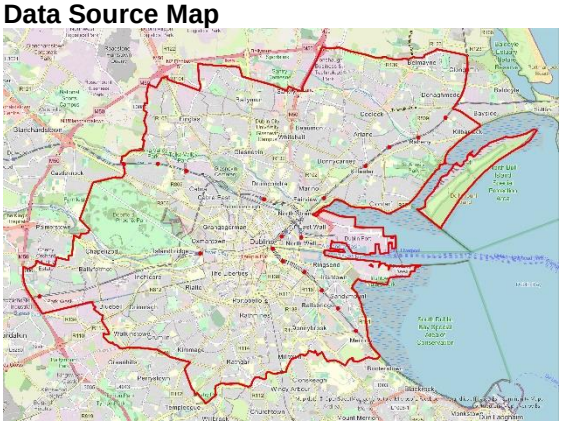
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750m decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

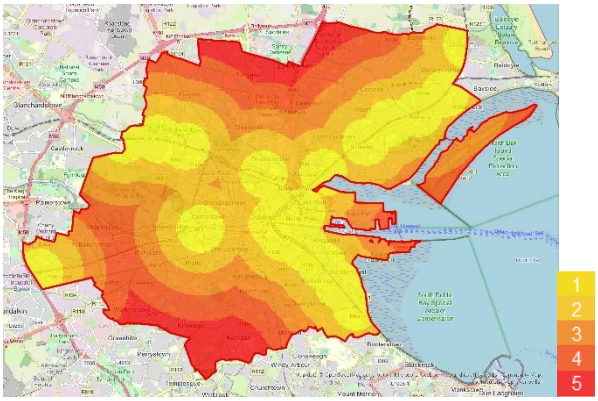
Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



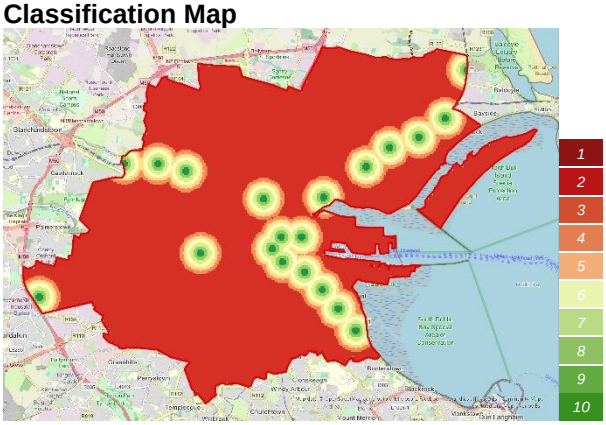
Data Source Map



Distance Accumulation



Classification Map



Reference
BREEAM Communities, Technical Manual

Retrieved from:
https://tools.breeam.com/bre_PrintOutput/BREEAM_Communities_0_1.pdf

Accessibility

Dublin Bike Stations

Description
Stations of NOW Dublin Bike

Total	111
Per Capita	5,339

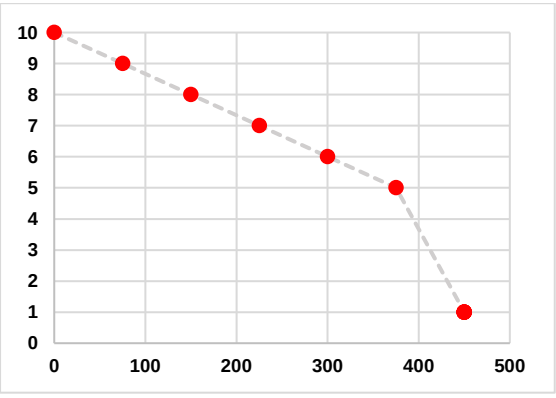
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

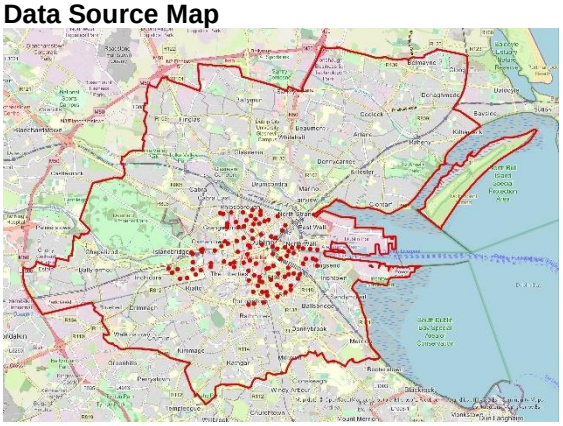
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <75m is standardised to 10. Distances between 75 and 450 decrease gradually in five intervals every 75m. Distances >450m is standardised to 1.

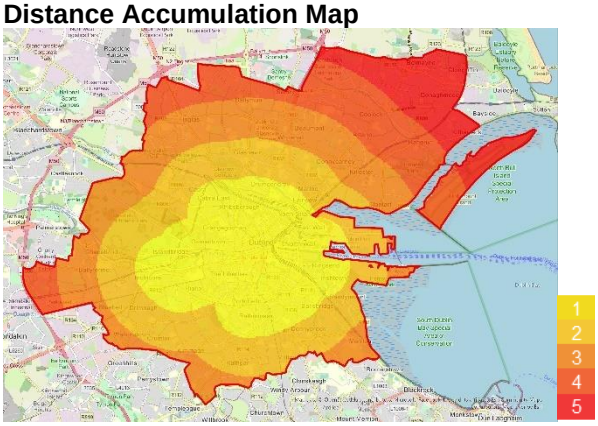
Value	Start (M)	End (M)
10	0	75
9	75	150
8	150	225
7	225	300
6	300	375
5	375	450
4	450	Extent
3	Null	Null
2	Null	Null
1	Null	Null



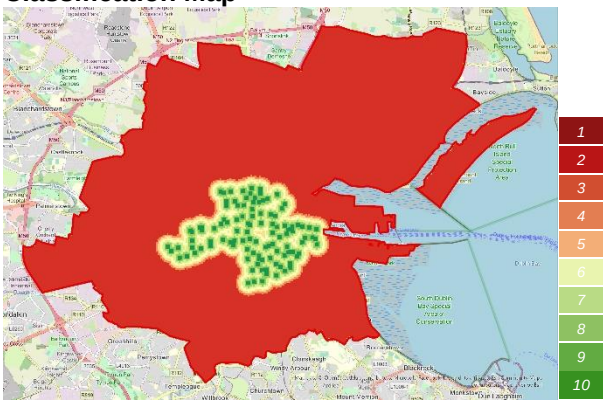
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Banerjee, S., Kabir, M. M., Khadem, N. K., & Chavis, C. (2020). Optimal locations for bikeshare stations: A new GIS based spatial approach. *Transportation Research Interdisciplinary Perspectives*, *4*, 100101.

Accessibility

Cycle Lanes

Description
Dedicated cycle lanes within the DCC area, ranging from protected to unprotected.

Total (Km)	240
Per Capita	2,469

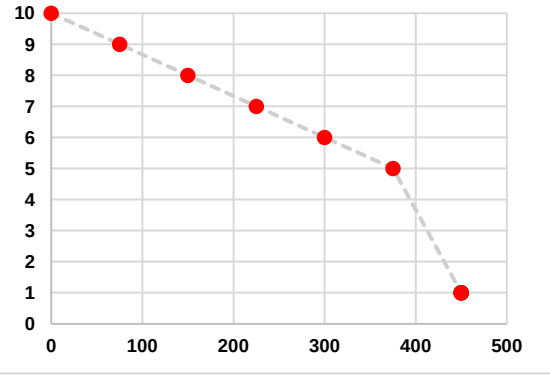
Data Source
National Transportation Authority

Operation
Selection by location within study area, export as feature class.

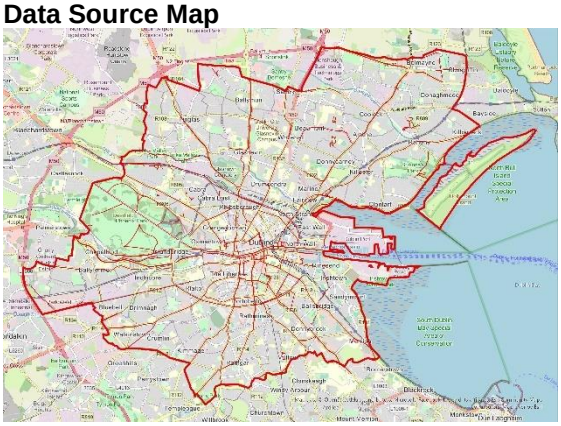
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <75m is standardised to 10. Distances between 75 and 450 decrease gradually in five intervals every 75m. Distances >450m is standardised to 1.

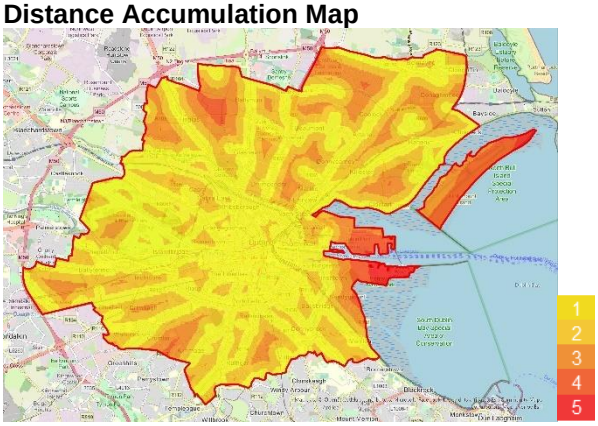
Value	Start (M)	End (M)
10	0	75
9	75	150
8	150	225
7	225	300
6	300	375
5	375	450
4	450	Extent
3	Null	Null
2	Null	Null
1	Null	Null



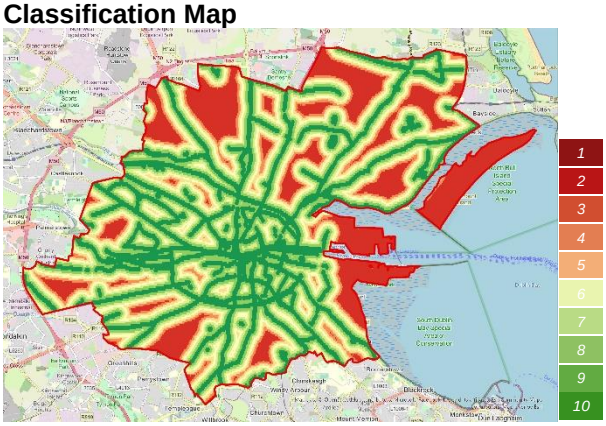
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Alberta Transportation

Retrieved from:
http://www.transportation.alberta.ca/Content/docType233/Production/26Bicycle_Crossing_Sign.pdf

Childcare

Description
Childcare services in Ireland are from the ages of two to six, the data contains the locations of crèches, Montessori schools and playschools.

Total	885
Per Capita	669

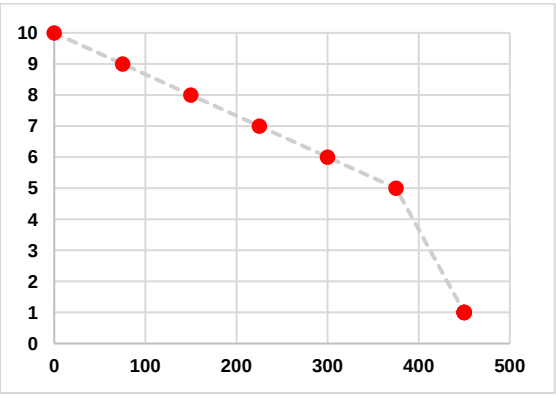
Data Source
Pobal

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <75m is standardised to 10. Distances between 75 and 450 decrease gradually in five intervals every 75m. Distances >450m is standardised to 1.

Value	Start (M)	End (M)
10	0	75
9	75	150
8	150	225
7	225	300
6	300	375
5	375	450
4	450	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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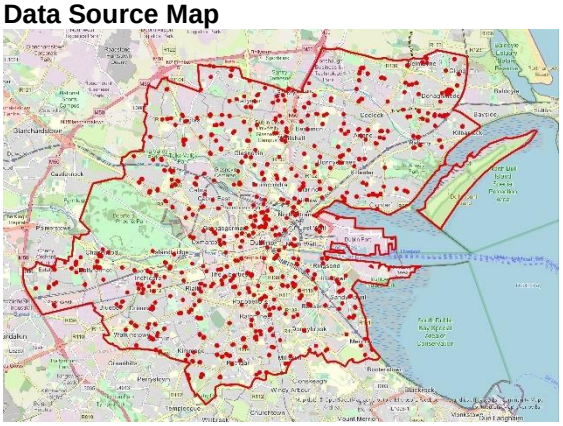

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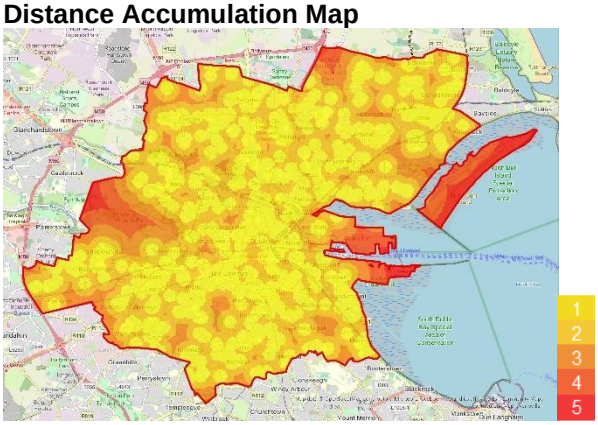

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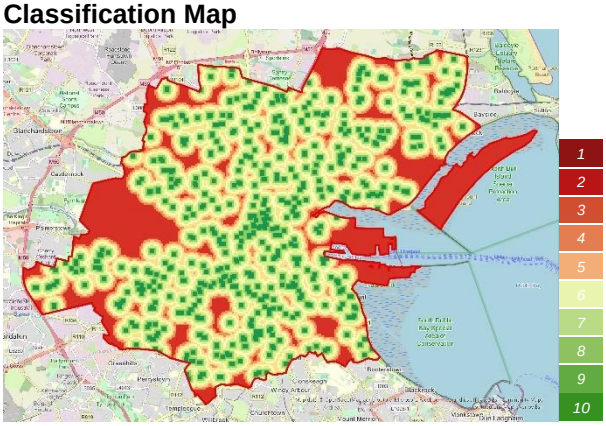


Reference
Rodríguez-López, C., Salas-Fariña, Z. M., Villa-González, E., Borges-Cosic, M., Herrador-Colmenero, M., Medina-Casaubón, J., ... & Chillón, P. (2017). The threshold distance associated with walking from home to school. Health Education & Behavior, 44(6), 857-866

Primary Schools

Description
Primary schools in Ireland are educational institutions that provide formal education to children between the ages of four and twelve years.

Total	188
Per Capita	3,152

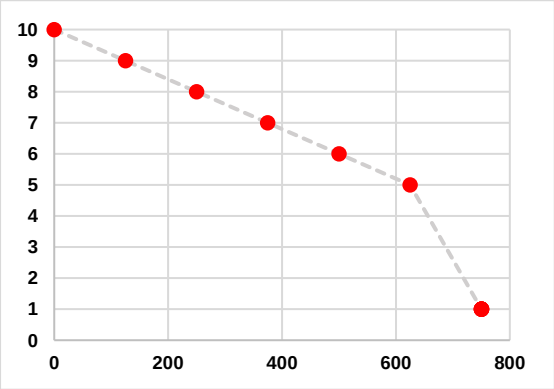
Data Source
Department of Education

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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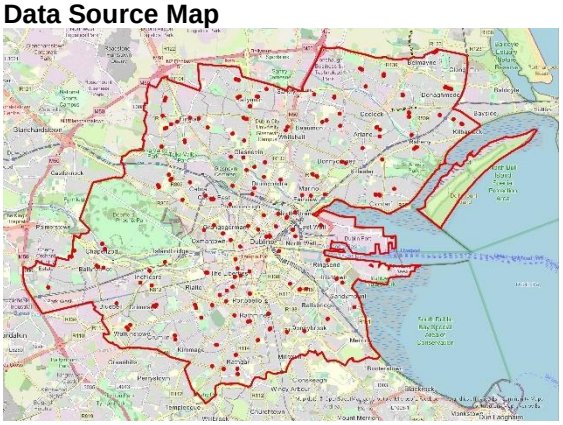
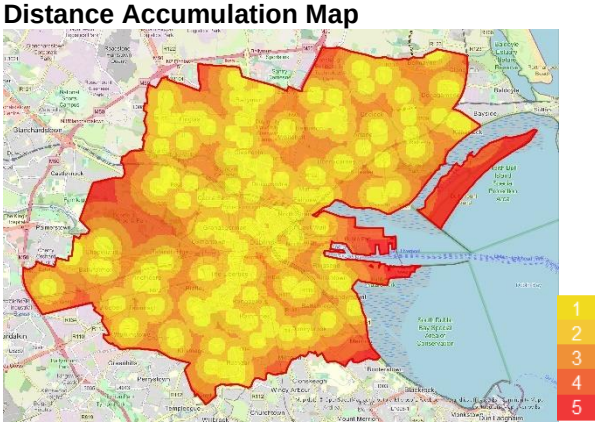


Distance Accumulation Map


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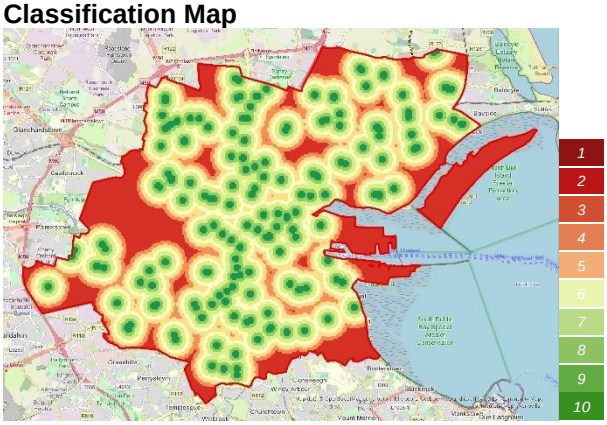


Reference
Rodríguez-López, C., Salas-Fariña, Z. M., Villa-González, E., Borges-Cosic, M., Herrador-Colmenero, M., Medina-Casaubón, J., ... & Chillón, P. (2017). The threshold distance associated with walking from home to school. Health Education & Behavior, 44(6), 857-866.

Post Primary Schools

Description
Post-primary schools in Ireland are educational institutions. These schools cater to students between the ages of twelve and eighteen.

Total	79
Per Capita	7,502

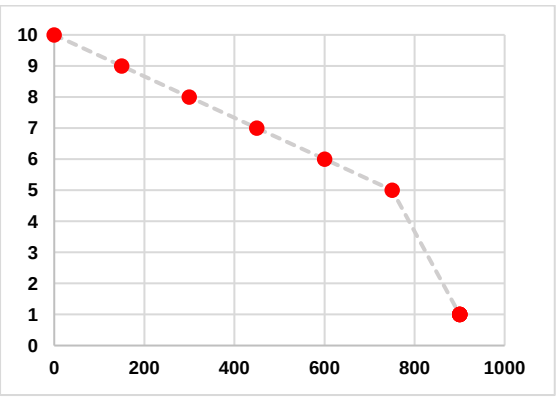
Data Source
Department of Education

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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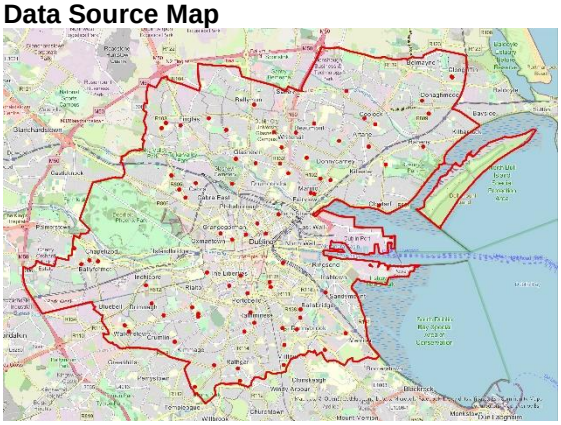

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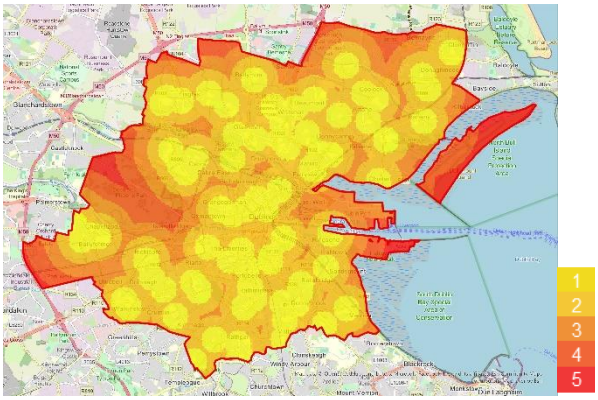

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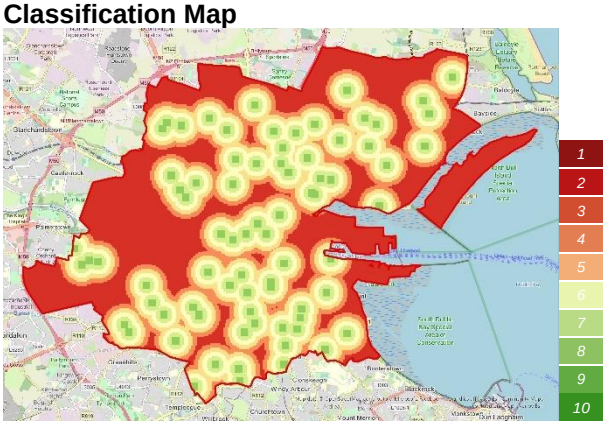


Reference
Rodríguez-López, C., Salas-Fariña, Z. M., Villa-González, E., Borges-Cosic, M., Herrador-Colmenero, M., Medina-Casaubón, J., ... & Chillón, P. (2017). The threshold distance associated with walking from home to school. Health Education & Behavior, 44(6), 857-866.

Special Schools

Description
Special schools in Ireland are educational institutions that cater to students with special educational needs (SEN).

Total	22
Per Capita	26,941

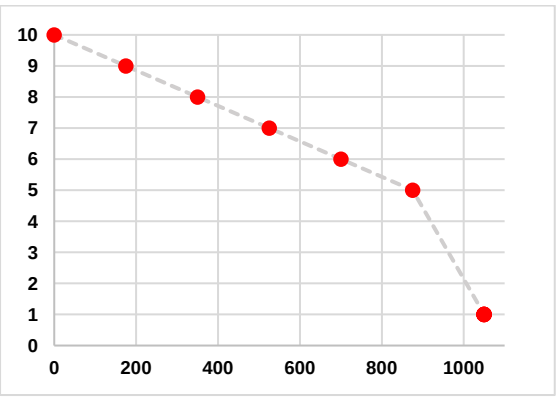
Data Source
Department of Education

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <175m is standardised to 10. Distances between 175 and 1050 decrease gradually in five intervals every 175m. Distances >1050m is standardised to 1.

Value	Start (M)	End (M)
10	0	175
9	175	350
8	350	525
7	525	700
6	700	875
5	875	1050
4	1050	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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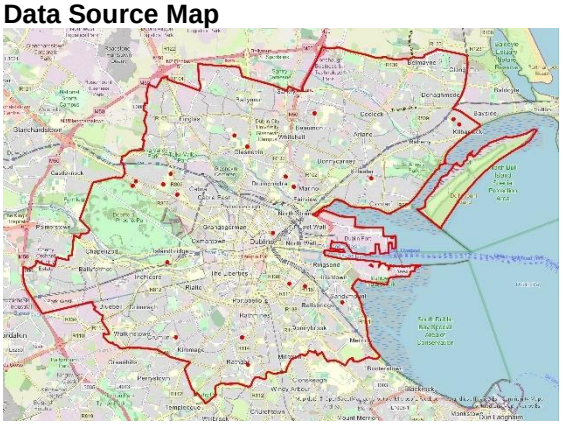

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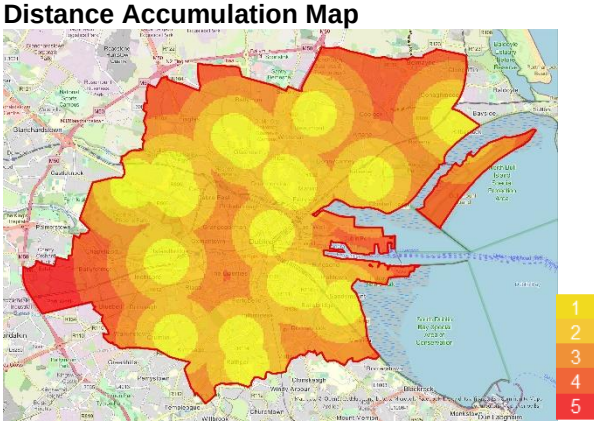

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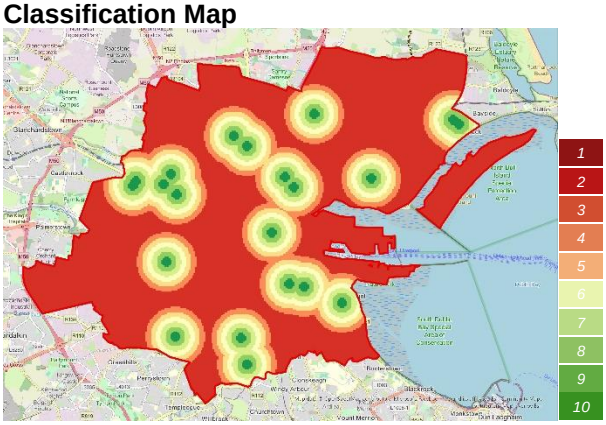


Reference
Rodríguez-López, C., Salas-Fariña, Z. M., Villa-González, E., Borges-Cosic, M., Herrador-Colmenero, M., Medina-Casaubón, J., ... & Chillón, P. (2017). The threshold distance associated with walking from home to school. Health Education & Behavior, 44(6), 857-866.

Libraries

Description
Libraries in Ireland are public institutions that provide access to a wide range of resources, including books, digital media, and educational materials.

Total	40
Per Capita	14,817

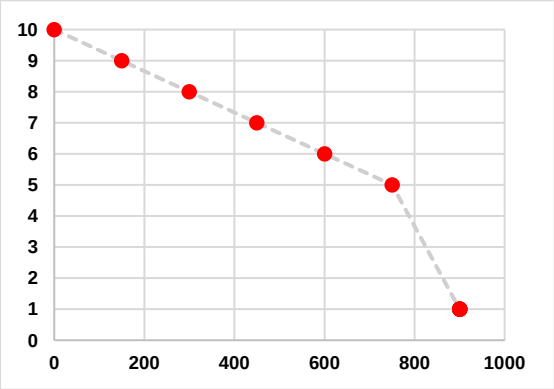
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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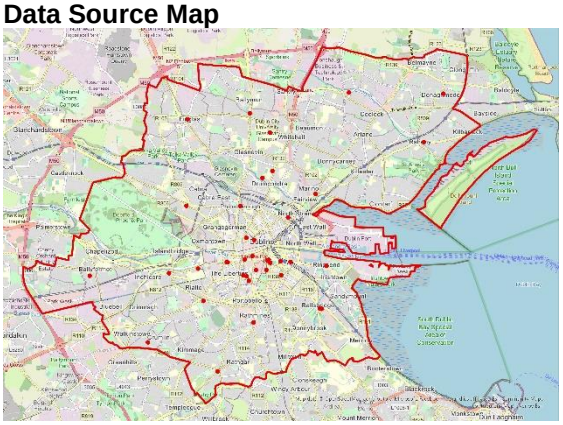

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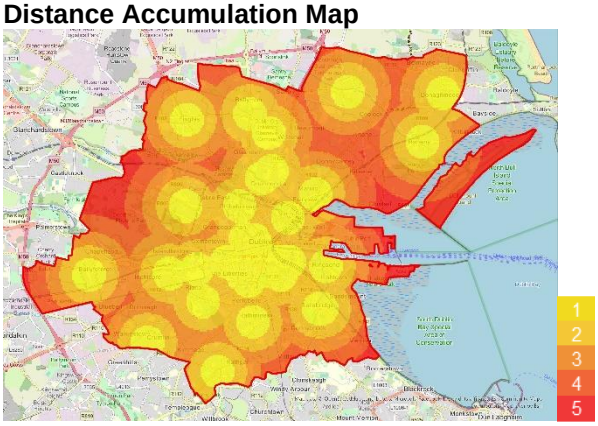

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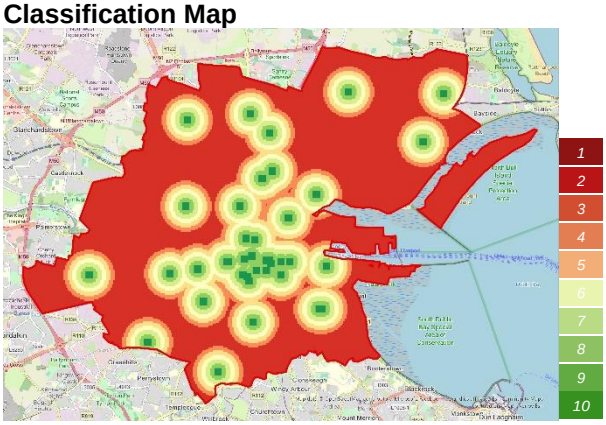


Reference
Park, S. J. (2012). Measuring public library accessibility: A case study using GIS. Library & information science research, 34(1), 13-21.

Public Toilets

Description
Public Toilets located often near public green spaces and in areas of high pedestrian frequency.

Total	28
Per Capita	21,168

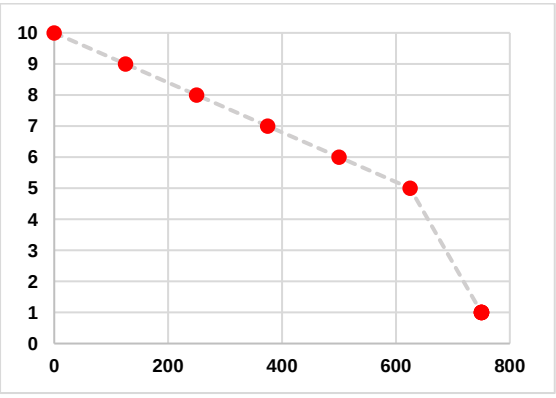
Data Source
Dublin City Council

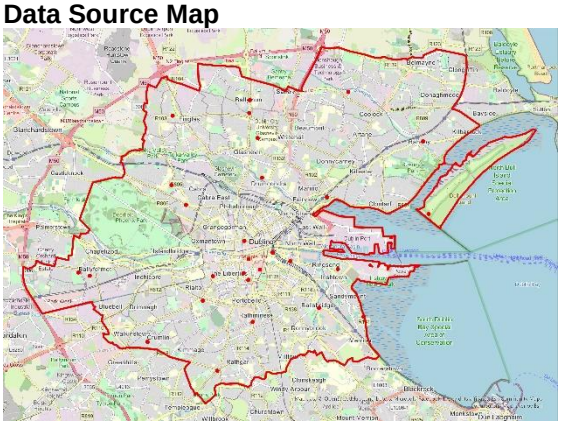
Operation
Selection by location within study area, export as feature class.

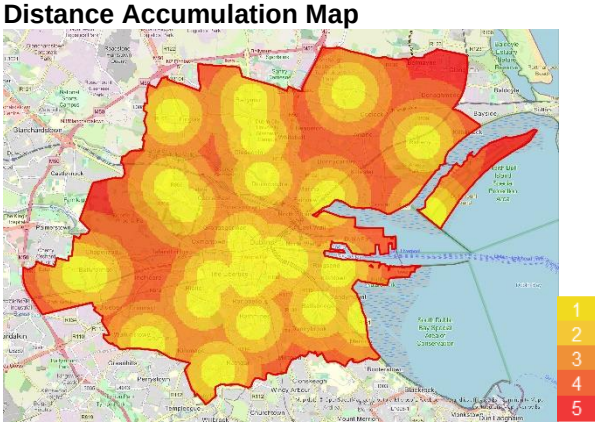
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



Data Source Map


Distance Accumulation Map


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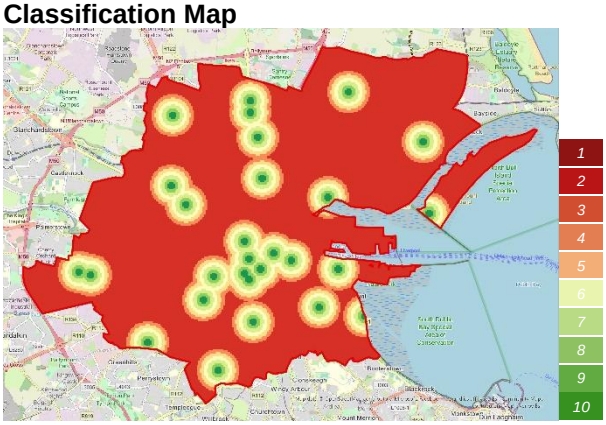


Reference
Han, L., Cheng, Y., Cui, Z., & Xi, G. (2021). Optimal layout of tourist toilets using resilience theory: An empirical study on Dunhua City in ethnic region of China. Plos one, 16(5), e0251696.

Pharmacies

Description
Pharmacies located in the study area.

Total	241
Per Capita	2,459

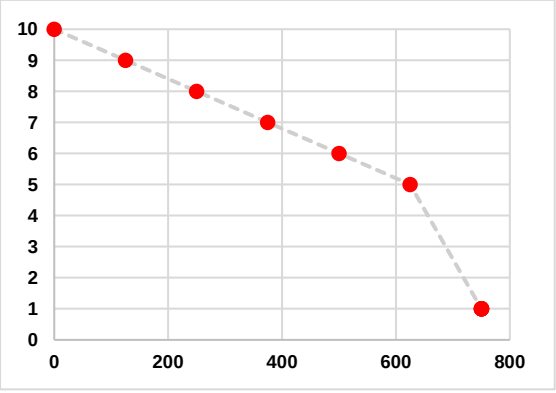
Data Source
Health Service Executive (HSE)

Operation
Selection by location within study area, export as feature class.

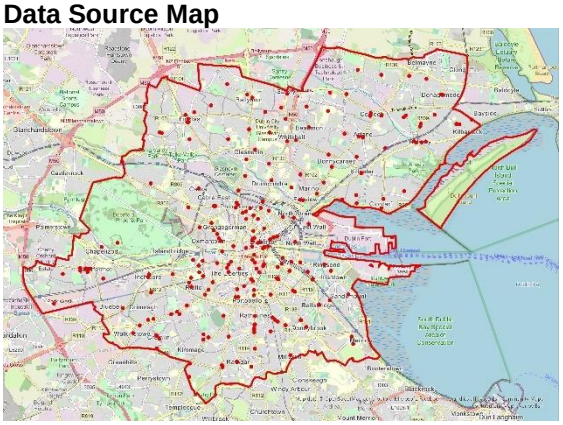
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

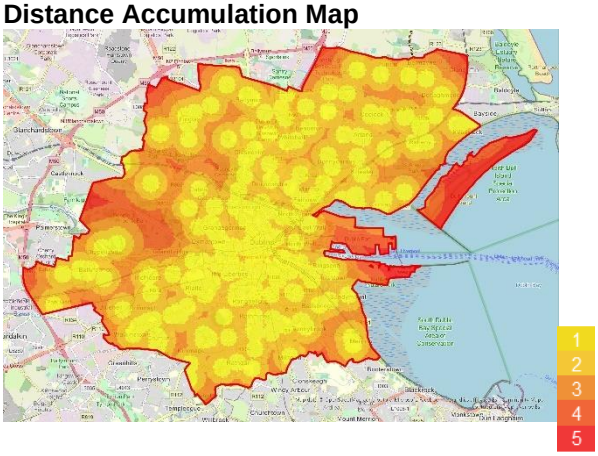
Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



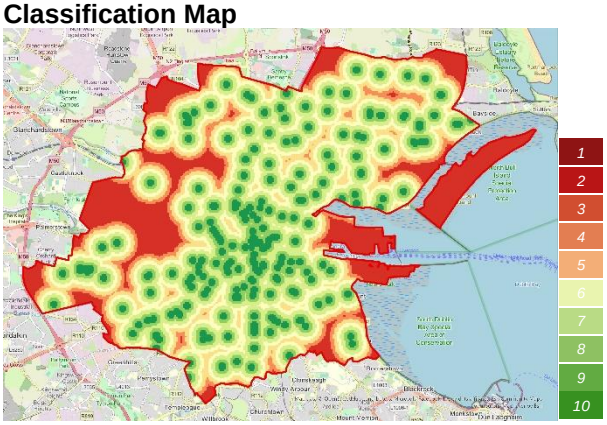
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Meshkini, A. H., Kebriaeezadeh, A., Janghorban, M. R., Keshavarz, K., & Nikfar, S. (2014). Assessment of geographic accessibility to pharmacy in Qom, Iran: a geographic information system analysis. Thrita, 3(1).

Doctors

Description
Doctors (General Practitioners) located in the study area.

Total	1,166
Per Capita	508

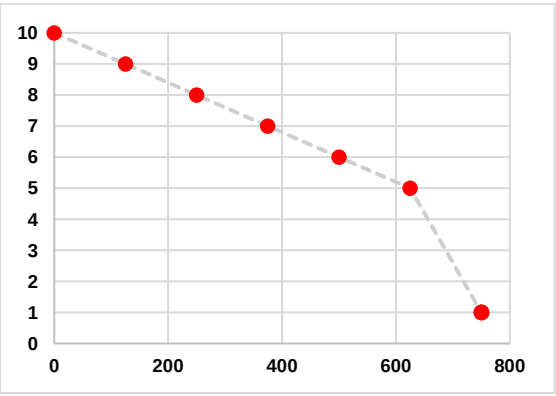
Data Source
Health Service Executive (HSE)

Operation
Selection by location within study area, export as feature class.

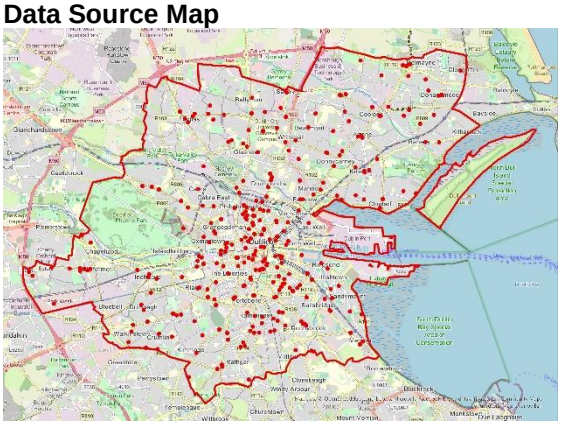
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

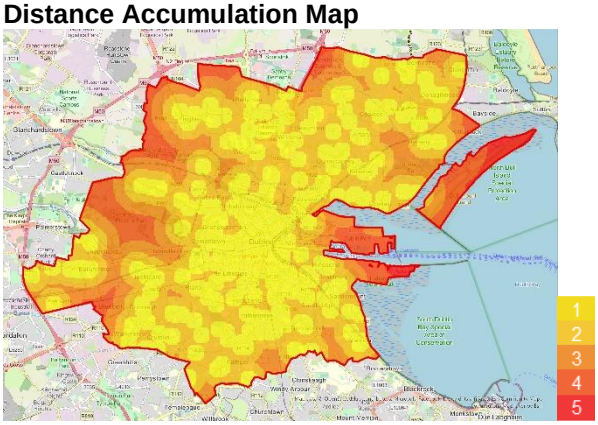
Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



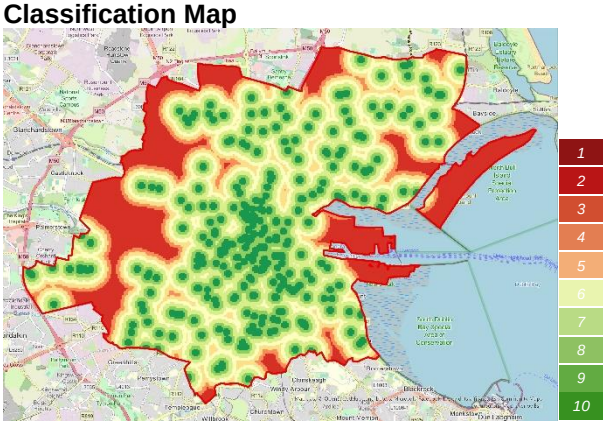
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Meshkini, A. H., Kebriaeezadeh, A., Janghorban, M. R., Keshavarz, K., & Nikfar, S. (2014). Assessment of geographic accessibility to pharmacy in Qom, Iran: a geographic information system analysis. Thrita, 3(1).

Health Care Centres

Description
Health care centres are key healthcare facilities that provide a wide range of primary care services to the local community.

Total	65
Per Capita	9,118

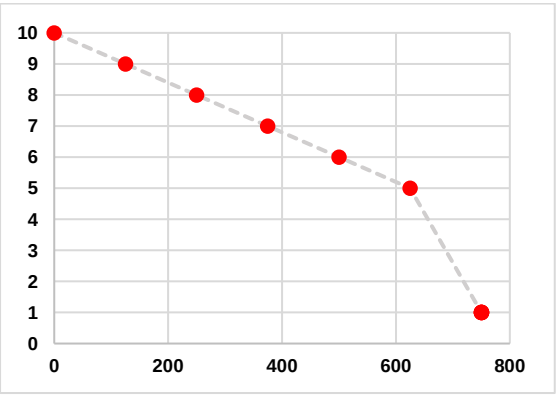
Data Source
Health Service Executive (HSE)

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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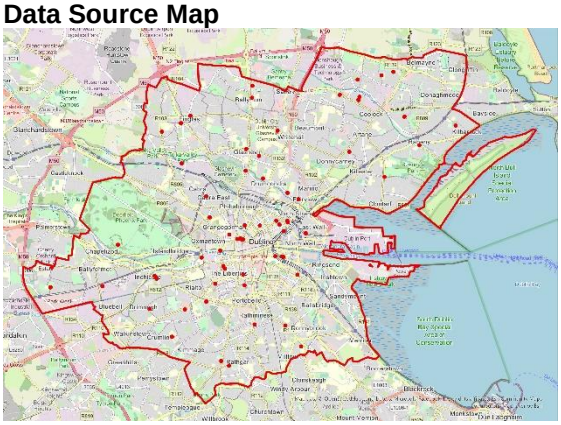

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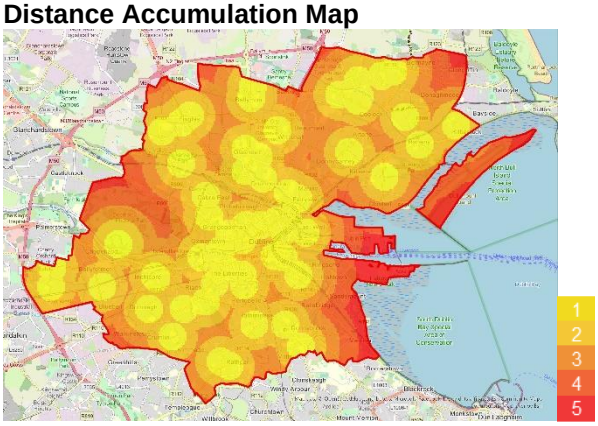

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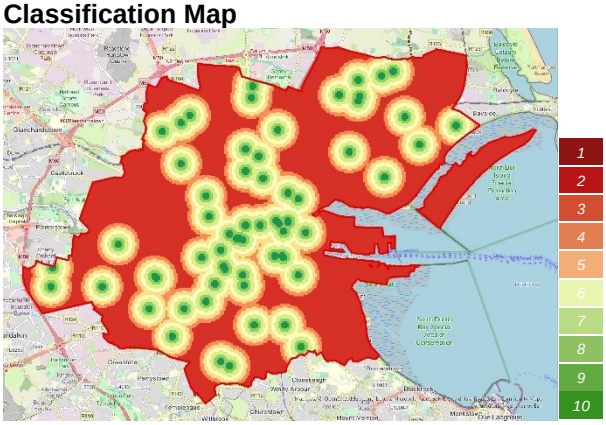


Reference
Meshkini, A. H., Kebriaeezadeh, A., Janghorban, M. R., Keshavarz, K., & Nikfar, S. (2014). Assessment of geographic accessibility to pharmacy in Qom, Iran: a geographic information system analysis. Thrita, 3(1).

Nursing Homes

Description
Nursing homes are residential facilities that provide care and support for elderly individuals.

Total	49
Per Capita	12,096

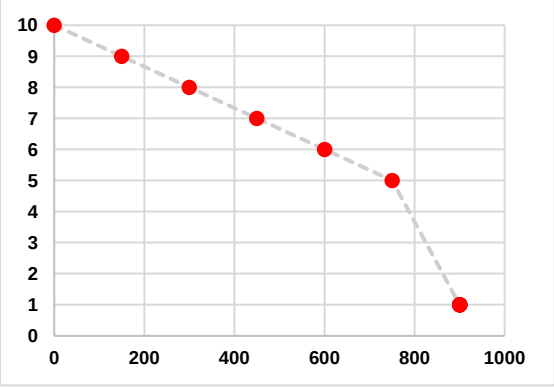
Data Source
Health Service Executive (HSE)

Operation
Selection by location within study area, export as feature class.

Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



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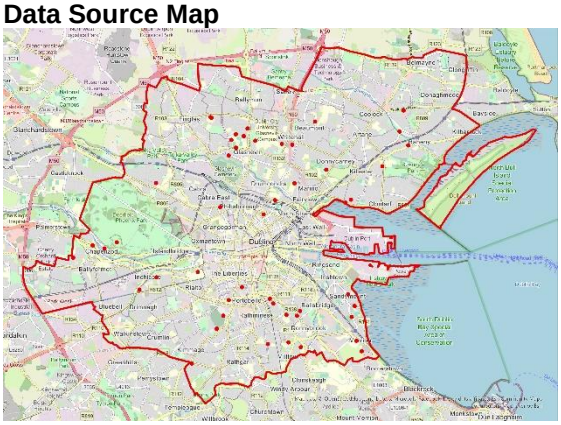
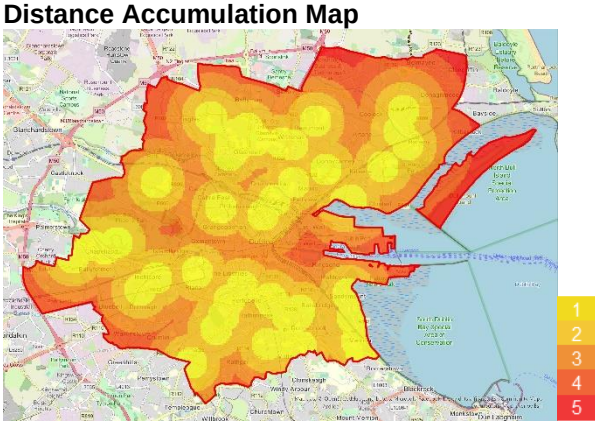


Distance Accumulation Map


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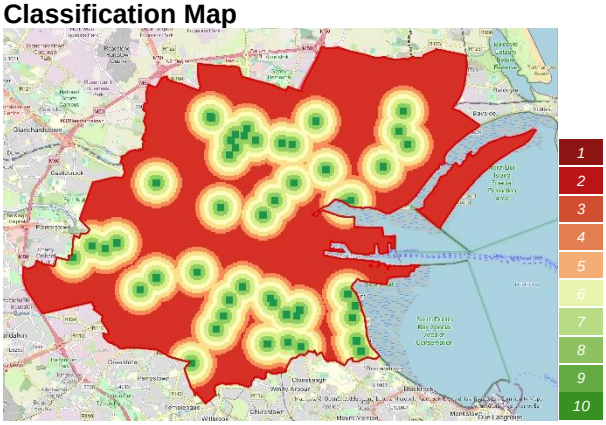


Reference
Benavent-Caballer, V., Lisón, J. F., Rosado-Calatayud, P., Amer-Cuenca, J. J., & Segura-Orti, E. (2015). Factors associated with the 6-minute walk test in nursing home residents and community-dwelling older adults. Journal of physical therapy science, 27(11), 3571-3578

Social Infrastructure & Services

Hospitals

Description
General Hospitals located in DCC.

Total	9
Per Capita	65,857

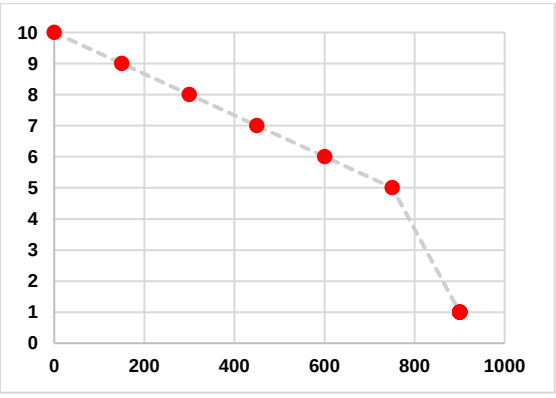
Data Source
Health Service Executive (HSE)

Operation
Selection by location within study area, export as feature class.

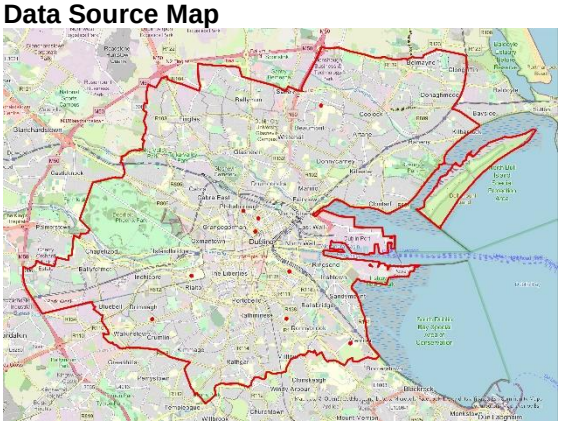
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

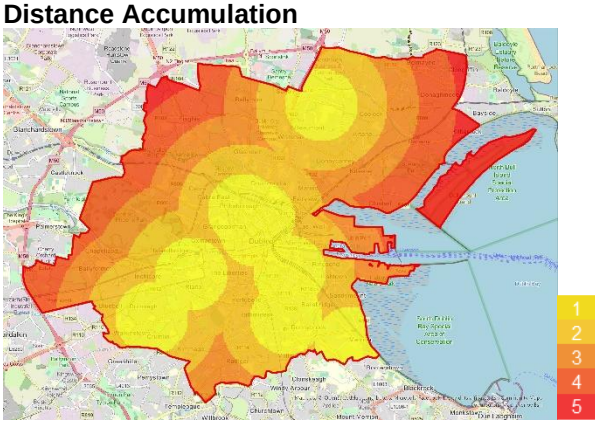
Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



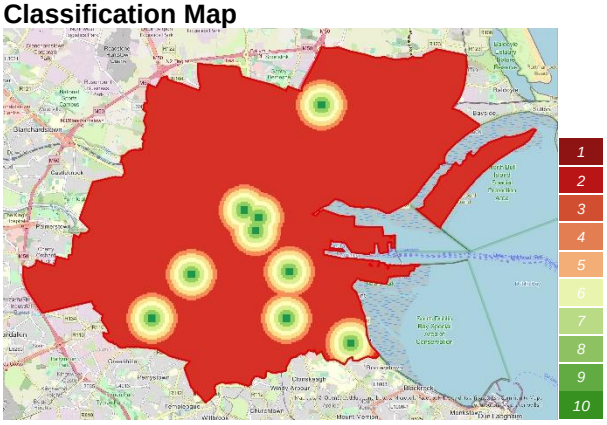
Data Source Map



Distance Accumulation



Classification Map



Reference
Coppola, P., & Silvestri, F. (2018). Estimating and visualizing perceived accessibility to transportation and urban facilities. Transportation Research Procedia, 31, 136-145.

Sports Facilities

Description
Dataset of sports clubs, facilities, and amenities.

Total	108
Per Capita	5,488

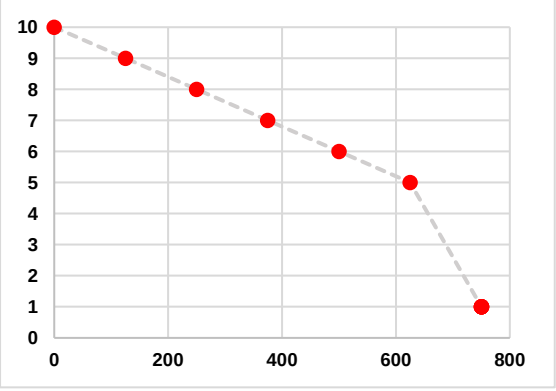
Data Source
Sports Ireland

Operation
Selection by location within study area, export as feature class.

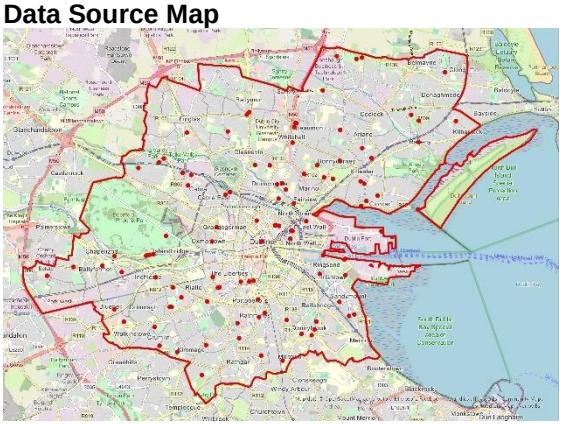
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <125m is standardised to 10. Distances between 125 and 750 decrease gradually in five intervals every 125m. Distances >750m is standardised to 1.

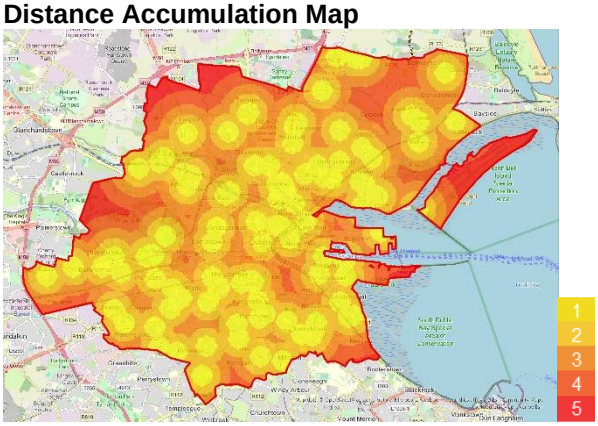
Value	Start (M)	End (M)
10	0	125
9	125	250
8	250	375
7	375	500
6	500	625
5	625	750
4	750	Extent
3	Null	Null
2	Null	Null
1	Null	Null



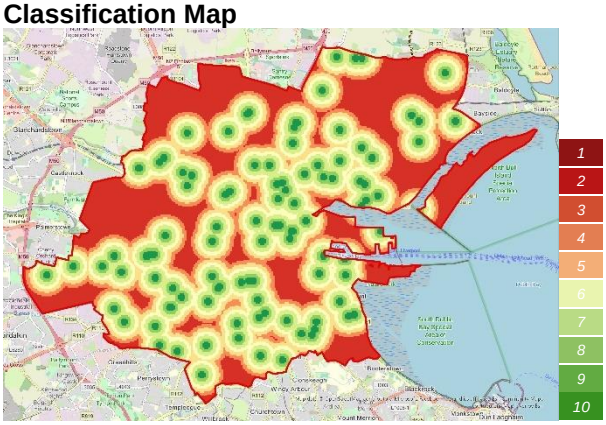
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Dublin City Development Plan 2022 - 2028

Museums

Description
Dataset of public museums in DCC.

Total	39
Per Capita	15,197

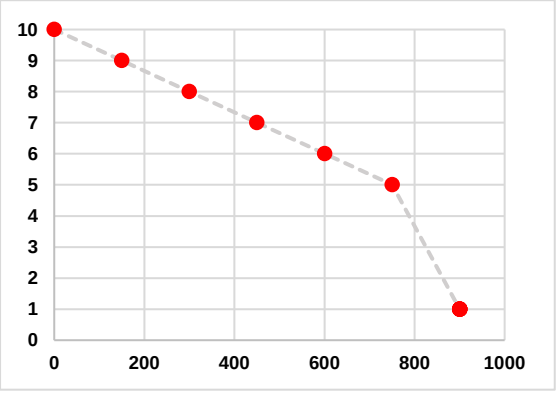
Data Source
Heritage Council

Operation
Selection by location within study area, export as feature class.

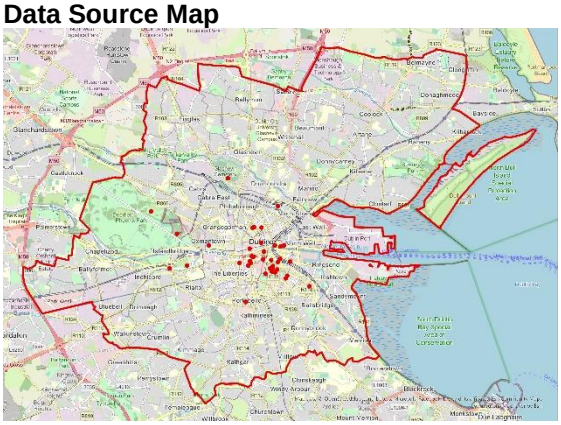
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease evenly in five intervals every 150m. Distances >900m is standardised to 1.

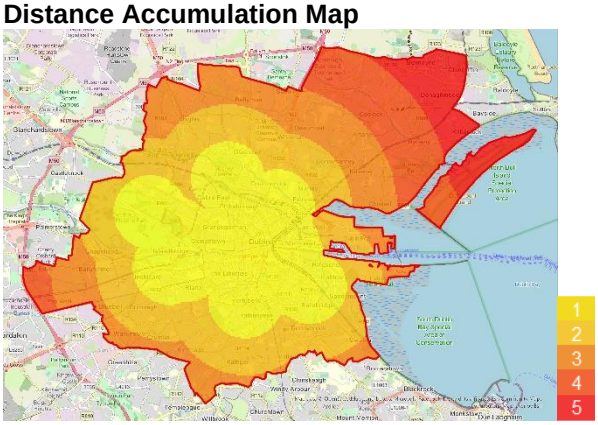
Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



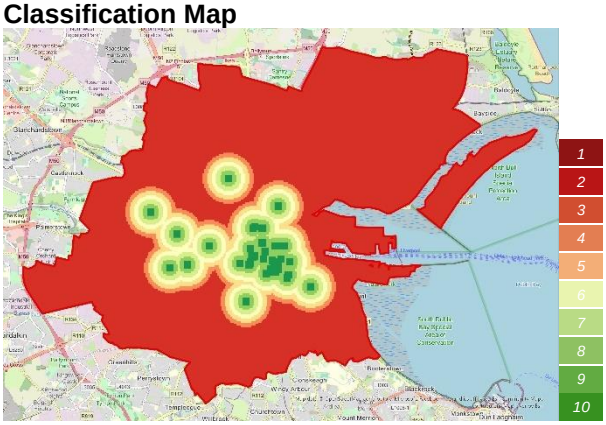
Data Source Map



Distance Accumulation Map



Classification Map



Reference
A Citizen's Guide to LEED for Neighborhood Development, U.S. Green Building Council, Natural Resources Defense Council, and the Congress for the New Urbanism

Public Realm

Air Quality

Description
The pollutants determined are Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Dioxide (NO2), NO (nitric oxide), Ozone (O3), and Particulate Matter PM2.5 (including size resolved particle counts from 0.3 - 2.5 µm).

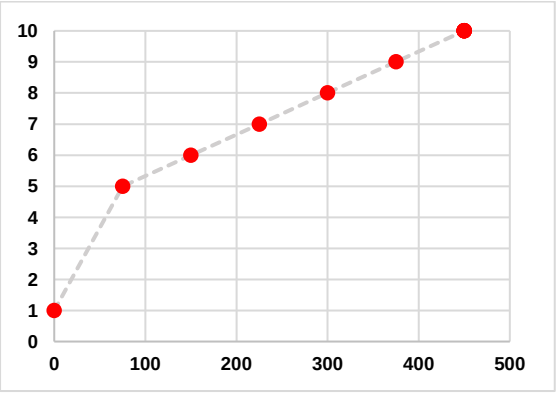
Data Source
Dublin City Council & Google

Operation
Select features > 40 ugm3 Nitrogen Dioxide (NO2)

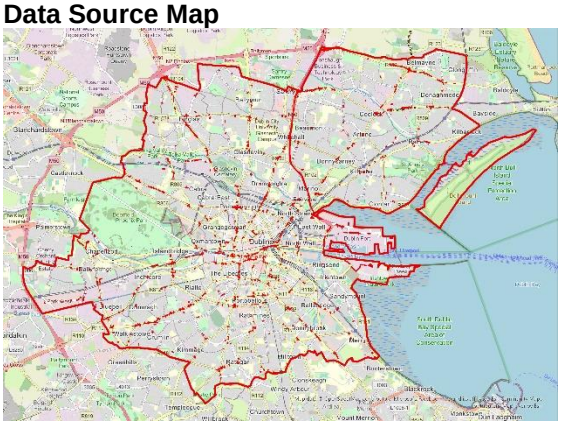
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <75m is standardised to 1. Distances between 75 and 450 decrease gradually in five intervals every 75m. Distances >450m is standardised to 10.

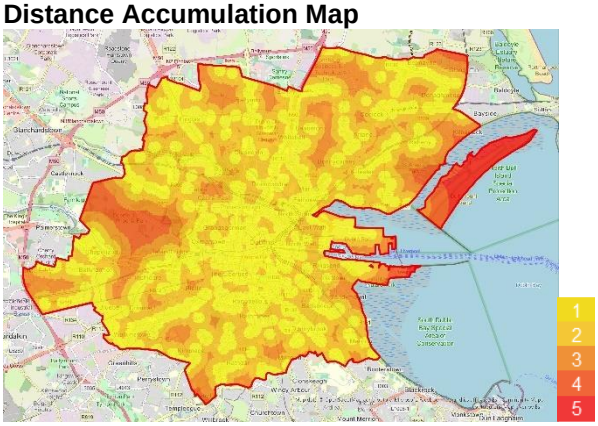
Value	Start (M)	End (M)
10	Null	Null
9	Null	Null
8	Null	Null
7	450	Extent
6	375	450
5	300	375
4	225	300
3	150	225
2	75	150
1	0	75



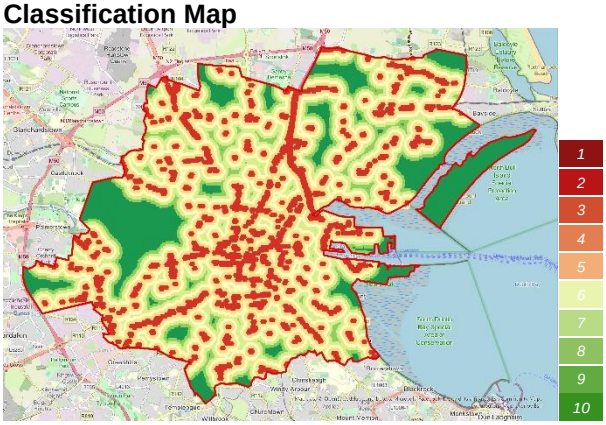
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Dublin Region Air Quality Plan 2021 & for Europe, W. R. O. (2013). Review of evidence on health aspects of air pollution–REVIHAAP Project: Technical Report [Internet].

Public Realm

Coastline

Description
The coastal shoreline of Dublin.

Total (Km)	52
Per Capita	11,398

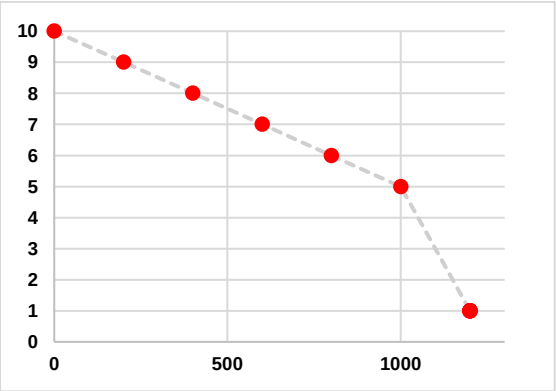
Data Source
Ordnance Survey Ireland

Operation
Selection by location within study area, export as feature class.

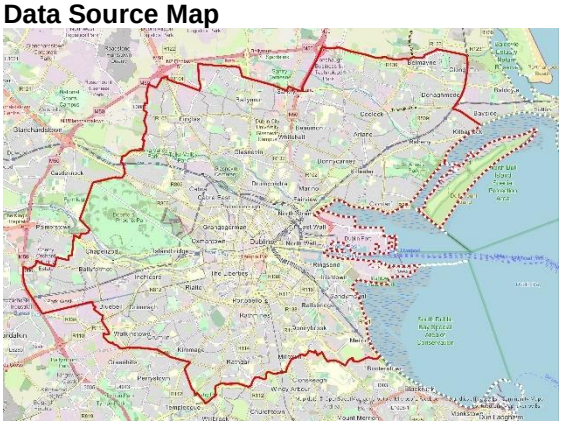
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <200m is standardised to 10. Distances between 200 and 1200 decrease gradually in five intervals every 200m. Distances >1200m is standardised to 1.

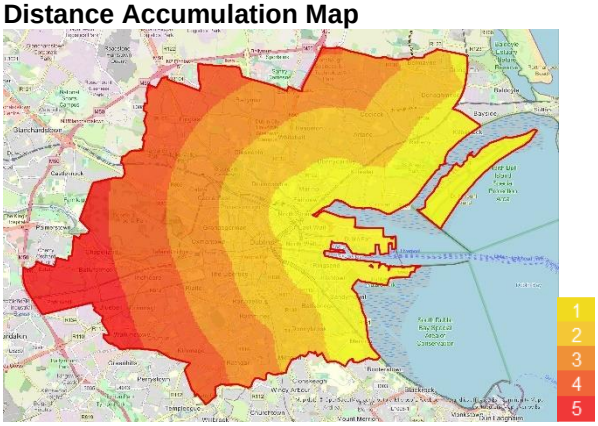
Value	Start (M)	End (M)
10	0	200
9	200	400
8	400	600
7	600	800
6	800	1000
5	1000	1200
4	1200	Extent
3	Null	Null
2	Null	Null
1	Null	Null



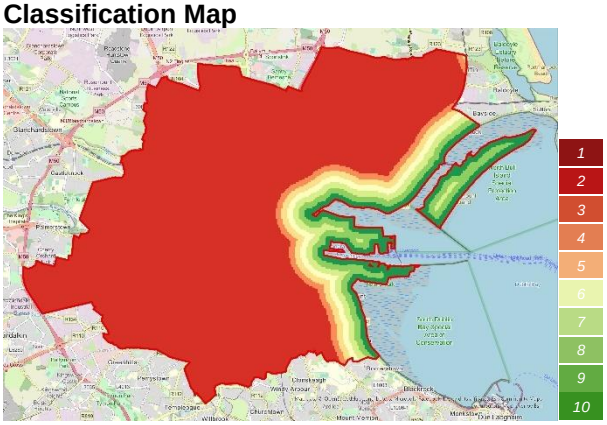
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Elliott, L. R., White, M. P., Grellier, J., Garrett, J. K., Cirach, M., Wheeler, B. W., ... & Fleming, L. E. (2020). Research Note: Residential distance and recreational visits to coastal and inland blue spaces in eighteen countries. Landscape and Urban Planning, 198, 103800.

Public Realm

Architectural Conservation Area

Description
The designated Architectural Conservation Area (ACA) aims to identify an area of special character and architectural interest and to preserve that special character.

Total (Sqm)	16,672,566
Sqm/Capita	28

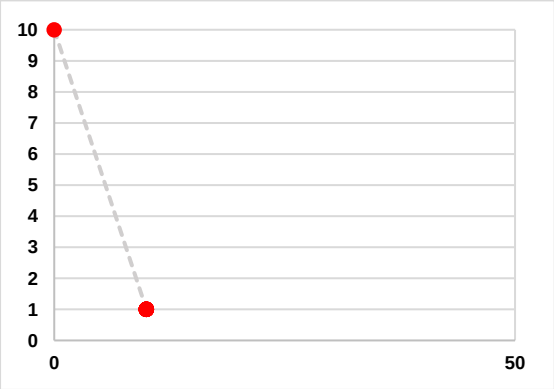
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

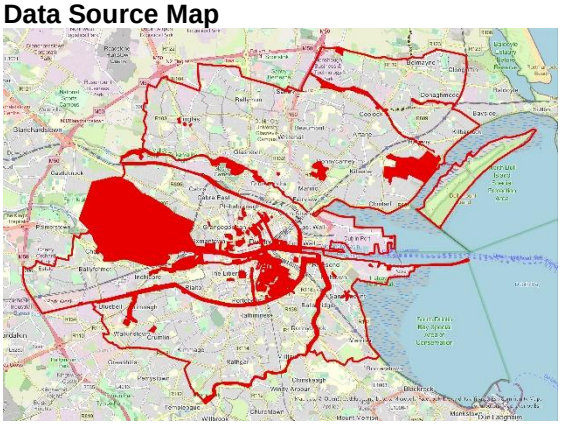
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <10m is standardised to 10. Distances >10m is standardised to 1.

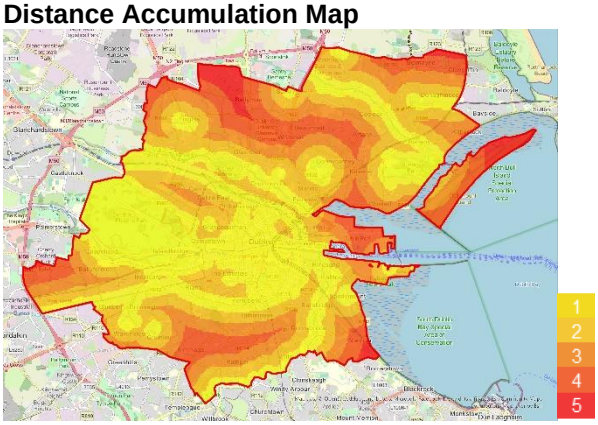
Value	Start (M)	End (M)
10	0	10
1	10	Extent



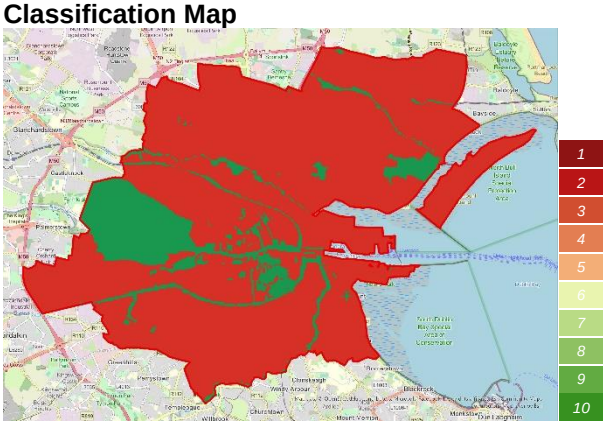
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Objective assessment of urban built environment related to physical activity – development, reliability and validity of the China Urban Built Environment Scan Tool (CUBEST) Defense Council, and the Congress for the New Urbanism

Public Realm

Sites & Monuments Record (SMR)

Description
The SMR contains details of all monuments and places (sites) where there is a monument known to the ASI pre-dating AD 1700 and includes monuments from the post-AD 1700 period.

Total	959
Per Capita	618

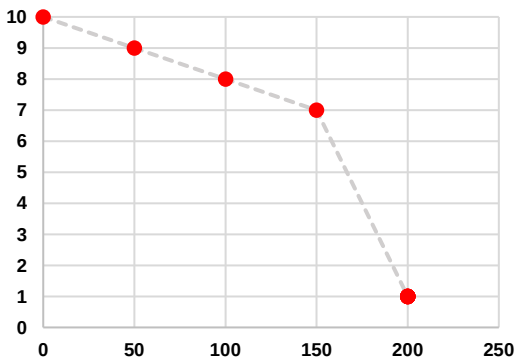
Data Source
National Monuments Service

Operation
Selection by location within study area, export as feature class.

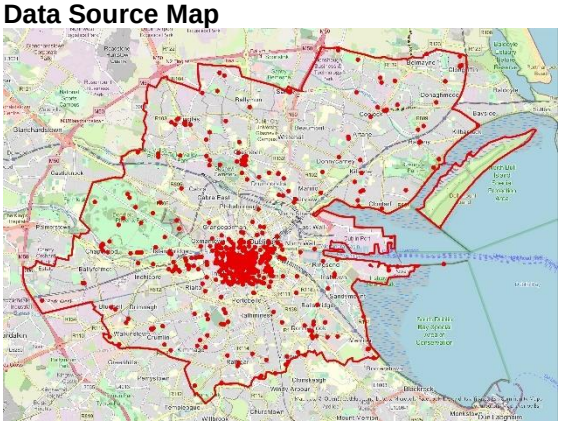
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 50 and 200 decrease gradually in four intervals every 50m. Distances >200m is standardised to 1.

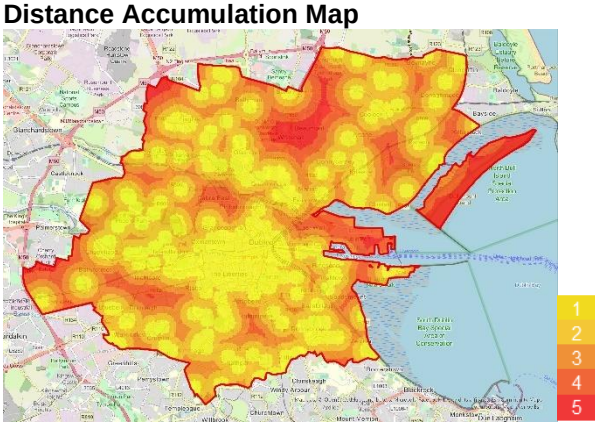
Value	Start (M)	End (M)
10	0	50
9	50	100
8	100	150
7	150	200
6	200	Extent
5	Null	Null
4	Null	Null
3	Null	Null
2	Null	Null
1	Null	Null



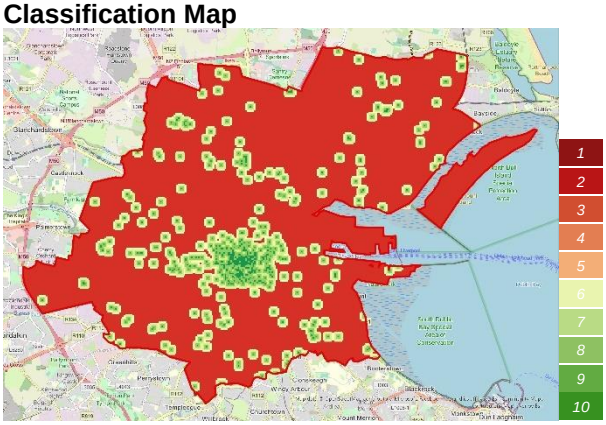
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Objective assessment of urban built environment related to physical activity – development, reliability and validity of the China Urban Built Environment Scan Tool (CUBEST) Defense Council, and the Congress for the New Urbanism

Public Realm

Nation Inventory of Architectural Heritage

Description
The data is extracted from Nation Inventory of Architectural Heritage database which identifies post-1700 architectural heritage of Ireland.

Total	5,907
Per Capita	100

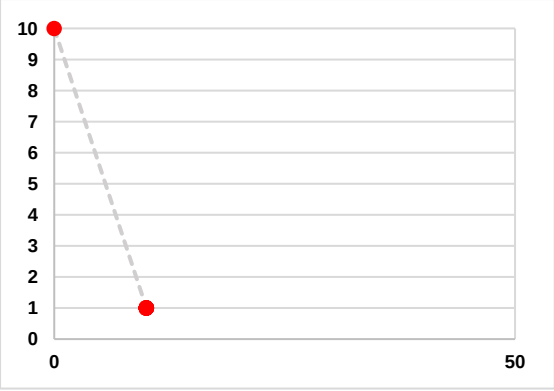
Data Source
National Inventory of Architectural Heritage

Operation
Selection by location within study area, export as feature class.

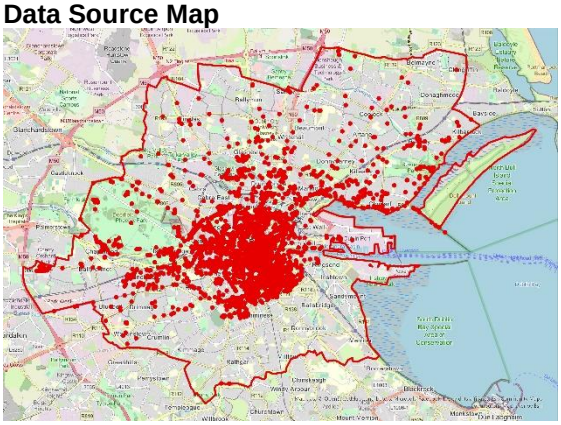
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <10m is standardised to 10. Distances >10m is standardised to 1.

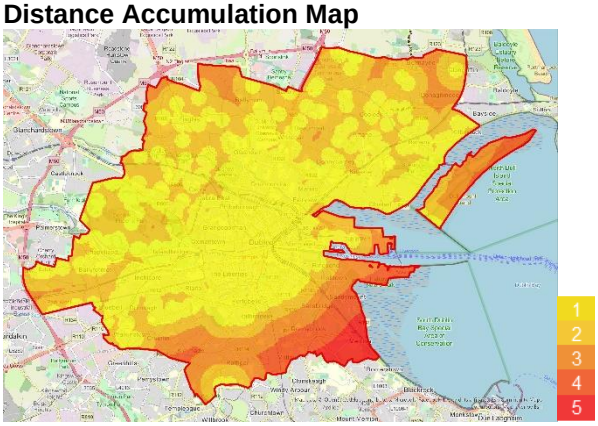
Value	Start (M)	End (M)
10	0	10
1	10	Extent



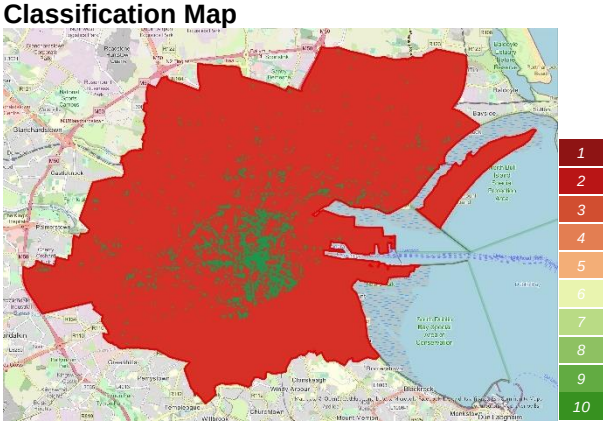
Data Source Map



Distance Accumulation Map



Classification Map



Reference
A Citizen's Guide to LEED for Neighborhood Development, U.S. Green Building Council, Natural Resources Defense Council, and the Congress for the New Urbanism

Public Realm

Public Lighting

Description
The data is extracted from Dublin City Council's streetlights management system and consists of public lighting assets in the Dublin City Council administrative area regardless of full asset ownership (Dublin City Council, ESB and LUAS assets are included).

Total	45,017
Per Capita	13

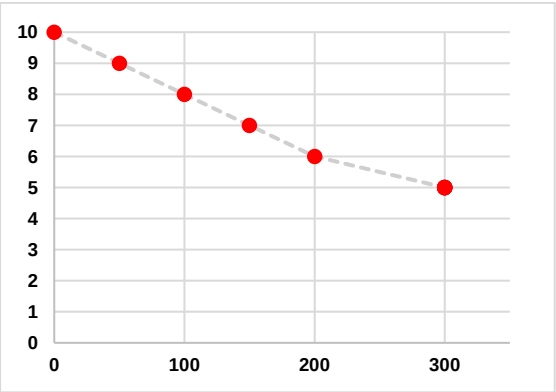
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

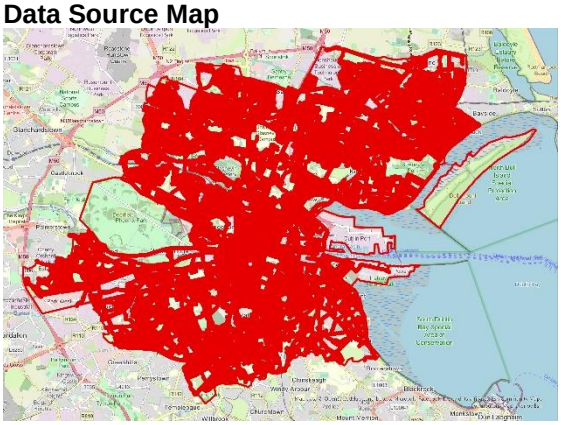
Point Density
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of density <50 points per square kilometer is standardised to 10. Densities between 50 and 300 decrease gradually in four intervals every 50m.

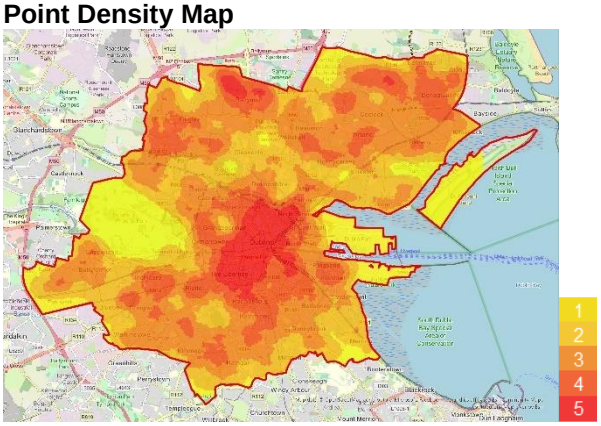
Value	Start (SqKm)	End (SqKm)
10	0	50
9	50	100
8	100	150
7	150	200
6	200	300
5	300	Extent



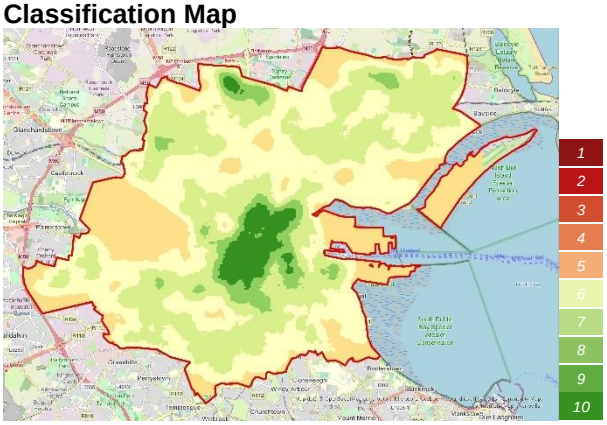
Data Source Map



Point Density Map



Classification Map



Reference
Active Neighborhood Checklist, Christine Hoehner, PhD, MSPH, Washington University in St. Louis

Public Realm

Trees

Description
The data was compiled as part of the Dublin Tree map initiative.

Total	303,981
Per Capita	1.95

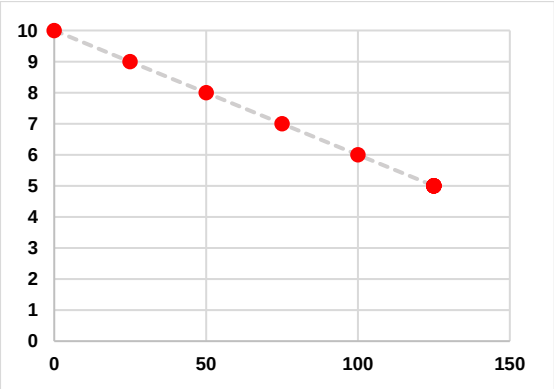
Data Source
Dublin City Council & University College Dublin

Operation
Selection by location within study area, export as feature class.

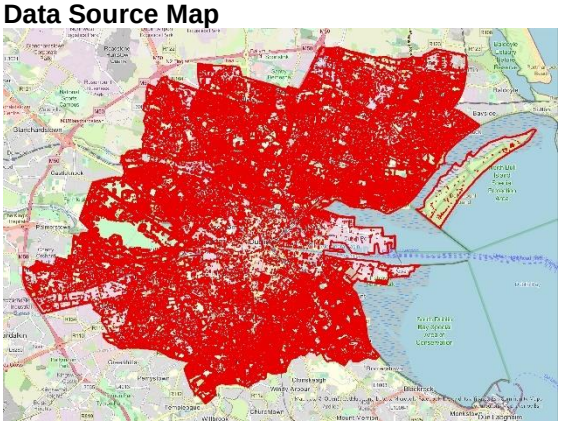
Point Density
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of density <25 points per ha is standardised to 10. Densities between 25 and 125 decrease gradually in four intervals every 25m.

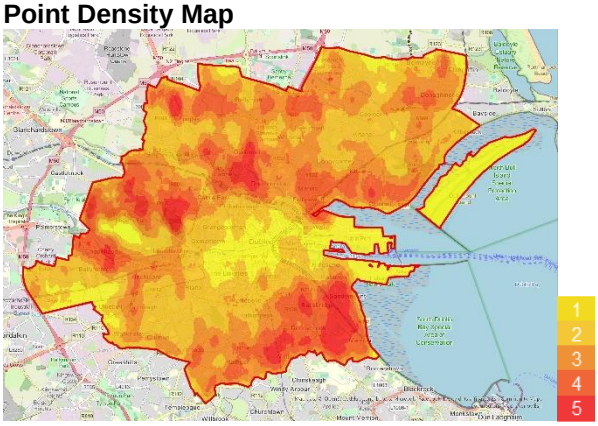
Value	Start (Ha)	End (Ha)
10	0	25
9	25	50
8	50	75
7	75	100
6	100	125
5	125	Extent



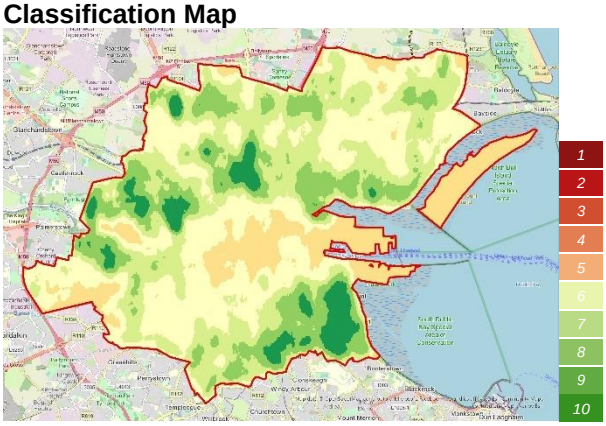
Data Source Map



Point Density Map



Classification Map



Reference
Mapping Green Dublin

Public Realm

Vacant and Derelict Sites

Description
Derelict Sites are structures in a ruinous, derelict or dangerous condition while Vacant Sites are areas in excess of 0.05 Ha.

Total	121
Per Capita	4,898

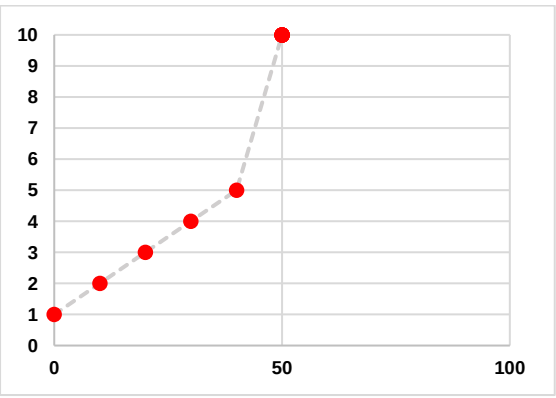
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

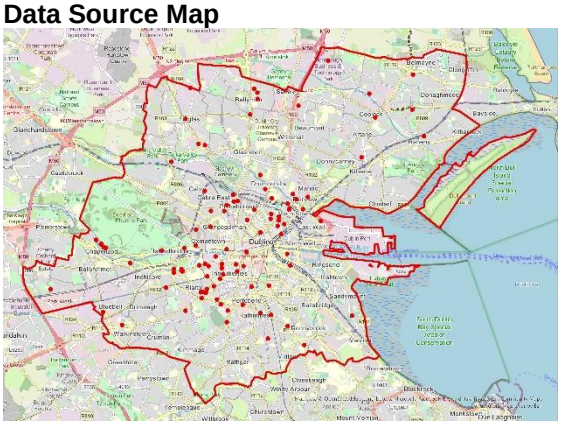
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <10m is standardised to 1. Distances between 75 and 50decrease gradually in four intervals every 10m. Distances >50m is standardised to 10.

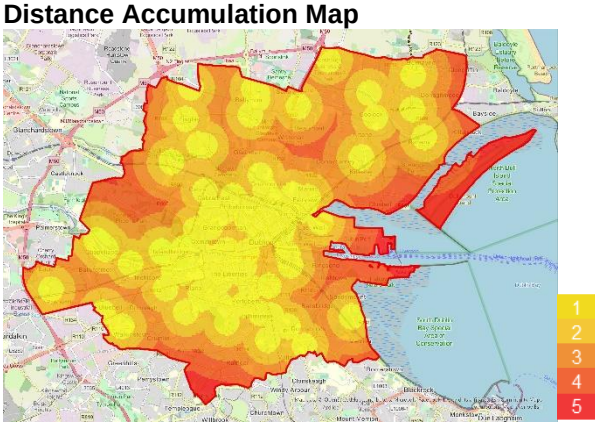
Value	Start (M)	End (M)
10	Null	Null
9	Null	Null
8	Null	Null
7	Null	Null
6	50	Extent
5	40	50
4	30	40
3	20	30
2	10	20
1	0	10



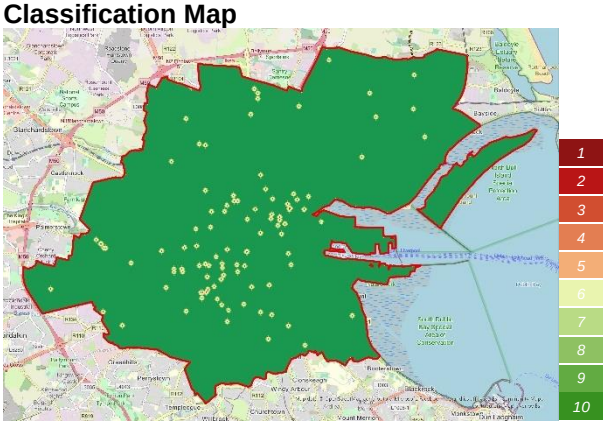
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Cunningham, C. R. (2006). House price uncertainty, timing of development, and vacant land prices: Evidence for real options in Seattle. *Journal of Urban Economics*, *59*(1), 1-31.

Public Realm

Seats & Beaches

Description
Public seating in the study area.

Total	900
Per Capita	658

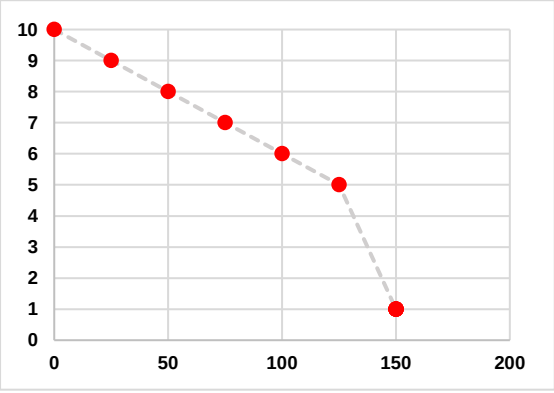
Data Source
Open Street Map

Operation
Selection by location within study area, export as feature class.

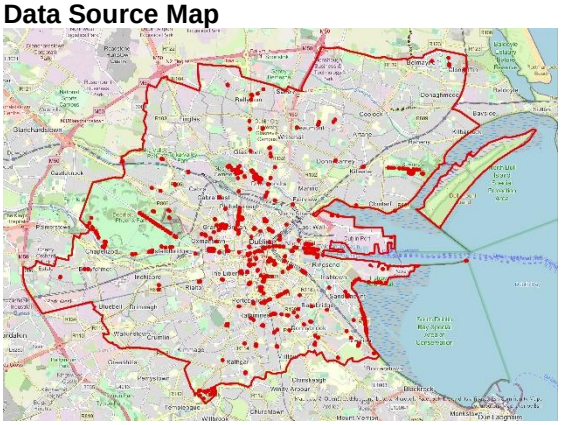
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <25m is standardised to 10. Distances between 25 and 150 decrease gradually in five intervals every 25m. Distances >150m is standardised to 1.

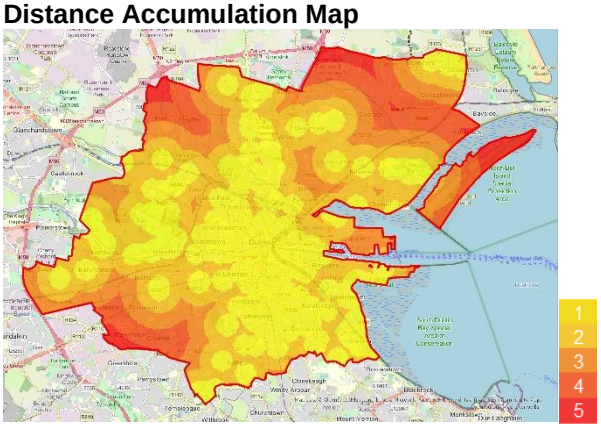
Value	Start (M)	End (M)
10	0	25
9	25	50
8	50	75
7	75	100
6	100	125
5	125	150
4	150	Null
3	Null	Null
2	Null	Null
1	Null	Null



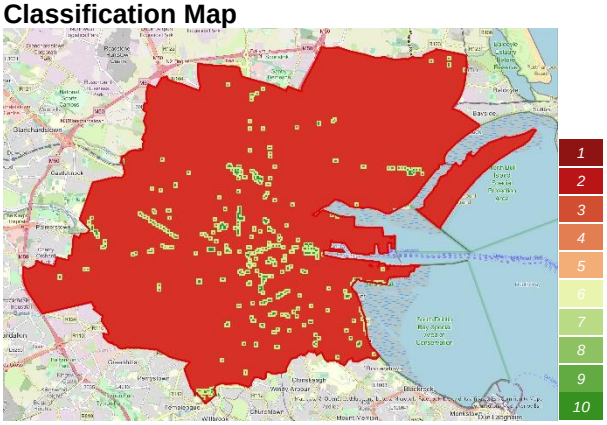
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Neckerman, K. M., Lovasi, G. S., Davies, S., Purciel, M., Quinn, J., Feder, E., ... & Rundle, A. (2009). Disparities in urban neighborhood conditions: evidence from GIS measures and field observation in New York City. Journal of public health policy, 30, S264-S285.

Public Realm

Public Green Space

Description
The data was compiled as part of the Mapping Green Dublin initiative. This dataset includes publicly accessible green space.

Total (Sqm)	23,445,900
Sqm/Capita	40

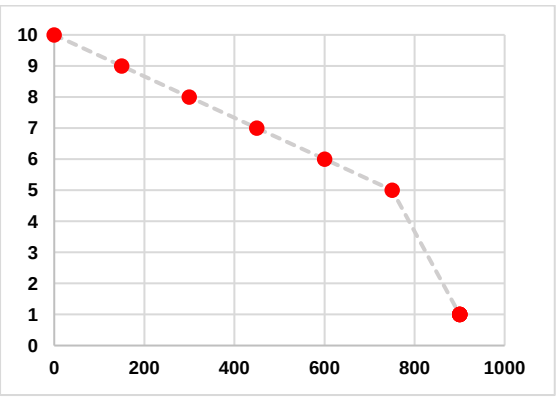
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

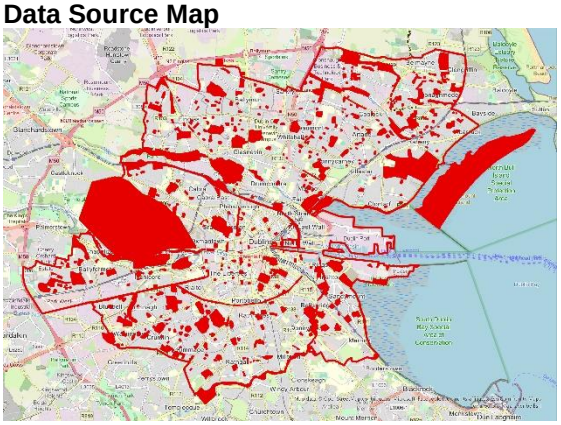
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

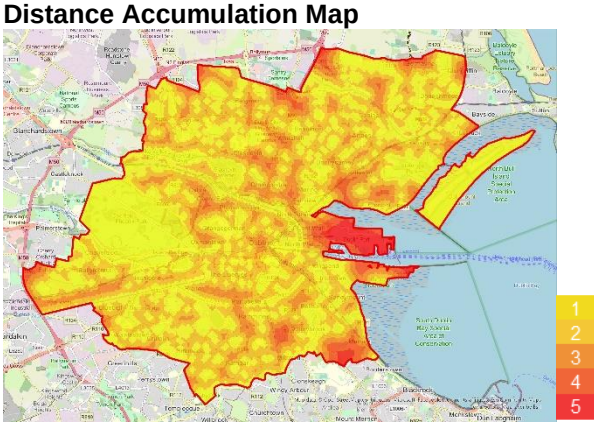
Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



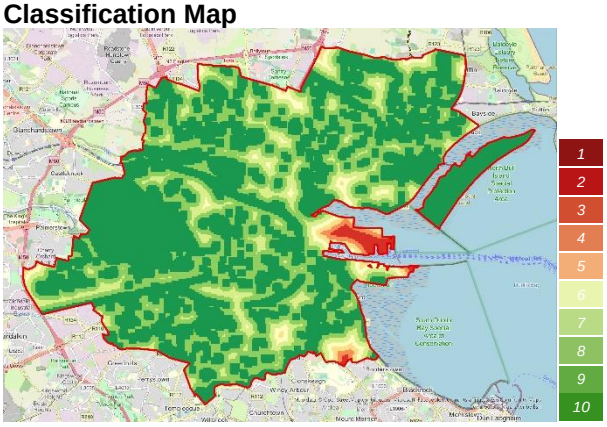
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Mayor, K., Lyons, S., Duffy, D., & Tol, R. S. (2009). A hedonic analysis of the value of parks and green spaces in the Dublin area (No. 331). ESRI working paper.

Public Realm

Public Allotments

Description
Allotments and community gardens are small plots of land used to grow vegetables and flowers for personal use, the data set contains those managed by DCC.

Total	17
Per Capita	34,865

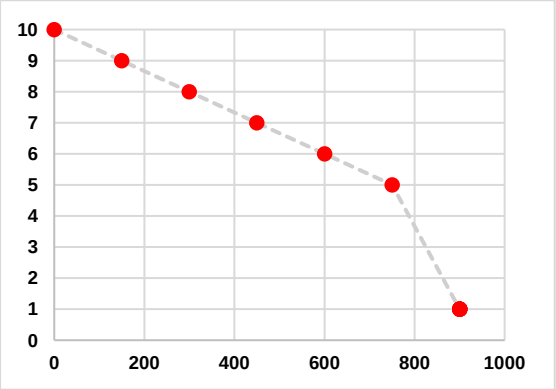
Data Source
Dublin City Council

Operation
Selection by location within study area, export as feature class.

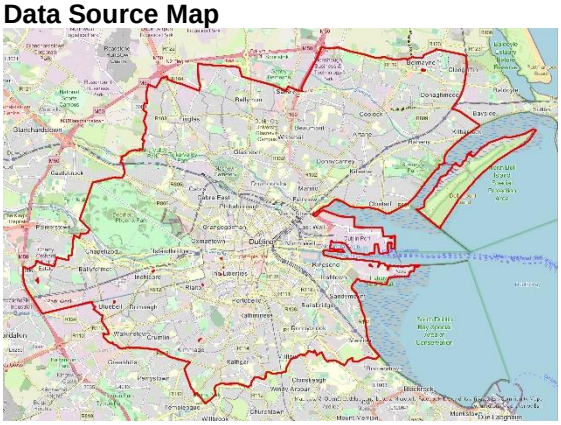
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <150m is standardised to 10. Distances between 150 and 900 decrease gradually in five intervals every 150m. Distances >900m is standardised to 1.

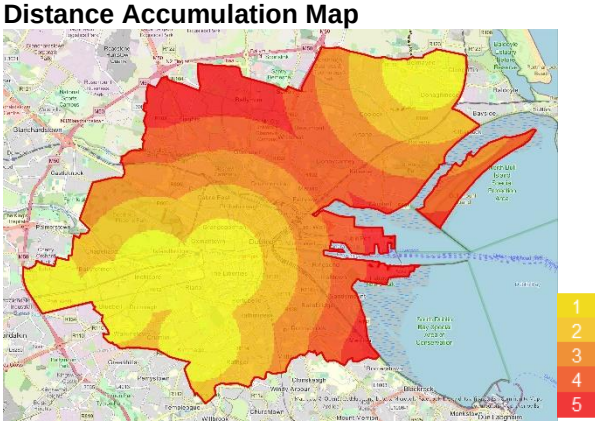
Value	Start (M)	End (M)
10	0	150
9	150	300
8	300	450
7	450	600
6	600	750
5	750	900
4	900	Extent
3	Null	Null
2	Null	Null
1	Null	Null



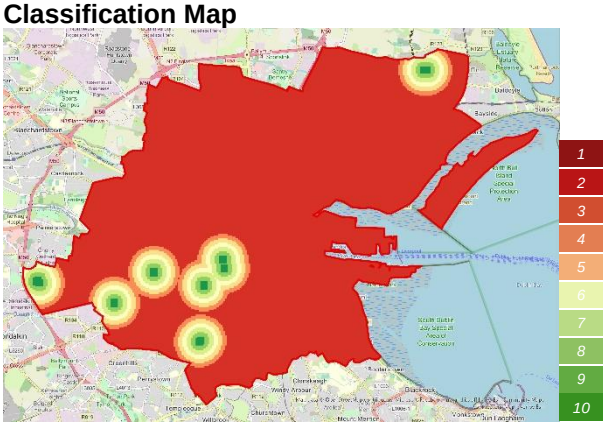
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Czembrowski, P., & Kronenberg, J. (2016). Hedonic pricing and different urban green space types and sizes: Insights into the discussion on valuing ecosystem services. Landscape and Urban Planning, 146, 11-19.

Public Realm

Noise

Description
A strategic noise map is a graphical representation of the predicted situation with regards to noise in a particular area and from noise sources, the sources of rail and road are combined to produce the data source map.

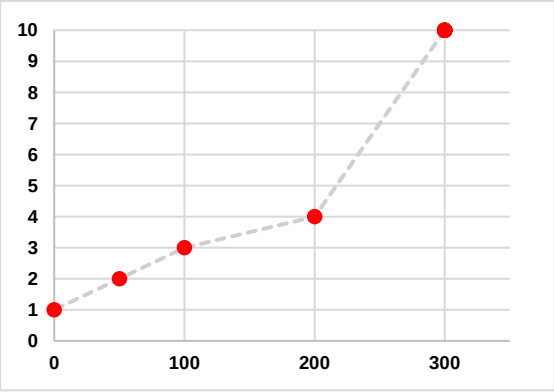
Data Source
Environmental Protection Agency (EPA)

Operation
Select feature by > 55 dB(A) Lday

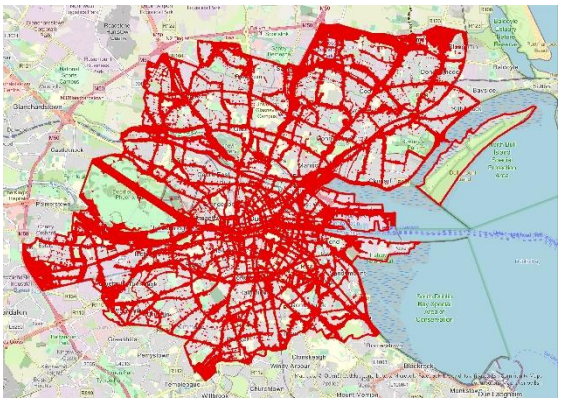
Distance Accumulation
Classify symbology, selected method is natural breaks (Jenks) with five classes. Illustrated with 25% transparency.

Value Function
Reclassification of Distances <50m is standardised to 1. Distances between 50 and 300 decrease gradually in four intervals of uneven size. Distances >300m is standardised to 10.

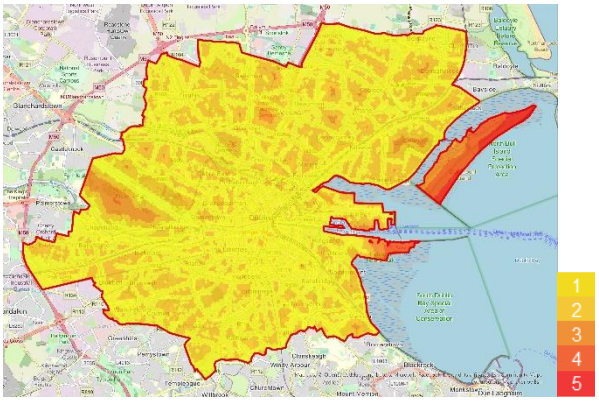
Value	Start (M)	End (M)
10	Null	Null
9	Null	Null
8	Null	Null
7	Null	Null
6	Null	Null
5	300	Extent
4	200	300
3	100	200
2	50	100
1	0	50



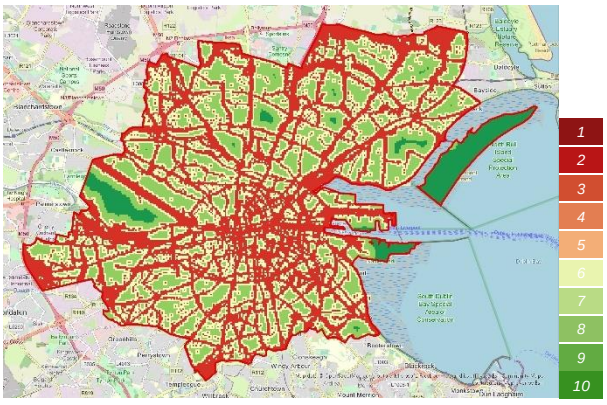
Data Source Map



Distance Accumulation Map



Classification Map



Reference
Dublin Agglomeration Action Plan 2018 - 2023

4.5.5 Stage 5 & Stage 6: Criteria Weights & Data Overlay

During Stage 4, which is Standardisation, Stage 5 plays an important role in determining the weight of each attribute for every component. This is done using the Equal Weighting method, which ensures that each attribute is equally important. It is recommended to combine Stage 5 with Stage 6, which is Data Overlay, as they are mutually relevant. In Stage 6, the criterion raster maps produced in Stage 4 are overlapped. A simplified data overlay scheme is illustrated in Fig 28 and will be applied below.

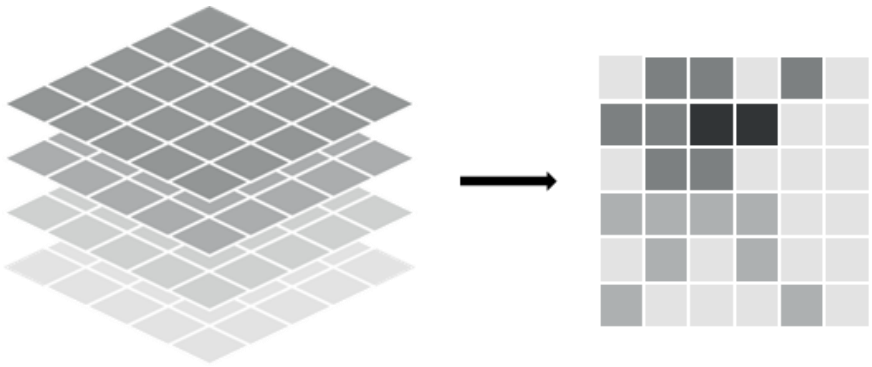


Figure 28 Data Overlay Scheme

Accessibility plays a pivotal role in shaping the quality of urban environments. It refers to the ease of movement and the ability to reach various destinations within a city. Understanding its significance, the evaluation framework for accessibility is a combination of five attributes. Each attribute is assigned a weightage of 20% or $\frac{1}{5}$, emphasising their equal importance in assessing this component of urban quality.

Attribute	Weight
Dublin Bus Stops	20%
Luas (Light rail) Stops	20%
Irish Rail Stations	20%
Dublin Bike Stations	20%
Cycle Lanes	20%
	100%

Table 9 Accessibility attribute equal weighting

The five attributes encompass various aspects of accessibility, encompassing factors. The Equal Weighting method ensures that all these attributes are recognised in the overall evaluation process.

The equal weightage granted to each attribute allows for a comprehensive and balanced assessment of accessibility. It fosters a holistic approach, considering both urban mobility's macro and micro aspects. By affording equal importance to all attributes, it acknowledges the interdependence and interconnectedness of various factors that contribute to the overall accessibility of Dublin.

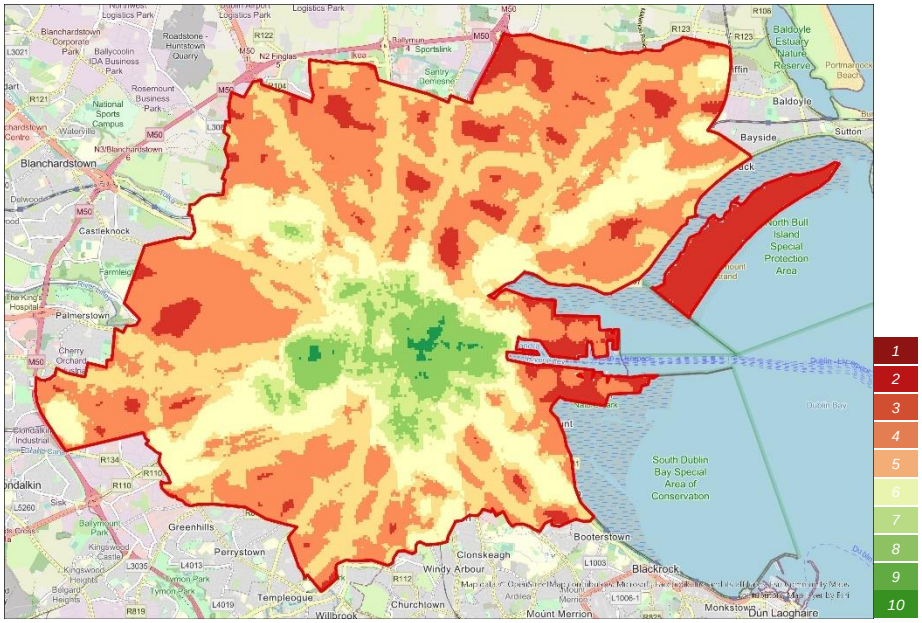


Figure 29 Accessibility Data Overlay

The map shown above (Fig 29) displays the concentration of accessibility in the centre of the study area, where modes of transportation such as Luas, Dublin Bikes, and Irish Rail are connected. This is not surprising, as city centres often have higher accessibility values. However, it is important to note the areas with a value of one. Bull Island, located to the east along Dublin Bay, and Phoenix Park, located to the west within the M50 motorway, are both fully isolated from an accessibility standpoint. When all attributes are equally weighted, the overall level of accessibility is concerning, with areas of high population density in the north of the study having poor accessibility values.

Stage 5 also aims to weight social infrastructure and services in the context of creating a value map. This component encompasses the facilities, amenities, and services that support and enhance the social well-being of residents. To ensure a fair evaluation, a total of thirteen attributes have been identified, each receiving an equal weightage of 7.7% or $\frac{1}{12}$.

Attribute	Weight
Childcare	7.7%
Primary Schools	7.7%
Post-Primary Schools	7.7%
Special Schools	7.7%
Libraries	7.7%
Public Toilets	7.7%
Pharmacies	7.7%
Doctors	7.7%
Health Centres	7.7%
Nursing Homes	7.7%
Hospitals	7.7%
Sports Facilities	7.7%
Museums	7.7%
	100%

Table 10 Services & Social Infrastructure attribute equal weighting

The Equal Weighting approach encourages a comprehensive evaluation of social infrastructure and services, enabling a thorough understanding of a city's capacity to meet the

social needs of its inhabitants. By assigning equal importance to each attribute, it recognises the significance of a multifaceted approach to urban quality. It underscores the need for a range of social amenities and services.

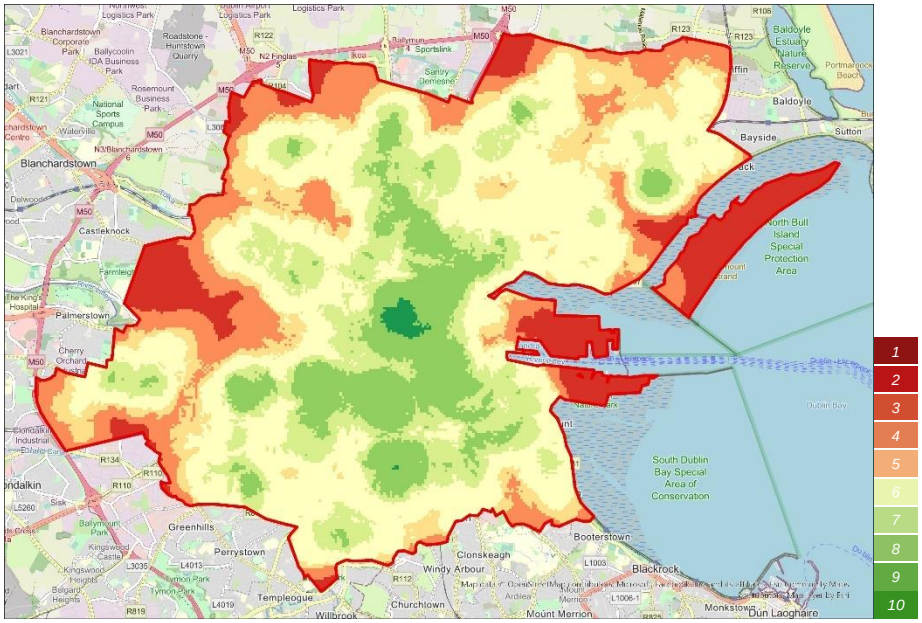


Figure 30 Services & Social Infrastructure Data Overlay

The map shown in Figure 30 illustrates the location of services and social infrastructure in the study area. It is clear that there is a significant concentration of value in the city centre. Additionally, there is a noticeable distribution in the north and south of the study area, which was not observed in Figure 29. When all factors are given equal weight, the overall level of services and social infrastructure is fairly distributed throughout the study area. This distribution aligns with the spatial plan of the Dublin, which aims to intersect neighbourhood and urban village centres, as stated in the Dublin City Development Plan.

The final component in Stage 5 pertains to evaluating the Public Realm, which encompasses the quality and accessibility of public spaces within urban environments. Thirteen attributes have been identified to assess this component, with each assigned an equal weightage of 8.3% or $\frac{1}{13}$.

Attribute	Weight
Air Quality	8.3%
Coastline	8.3%
Architectural Conservation Area	8.3%
Derelict & Vacant Sites	8.3%
Sites & Monuments Record (SMR)	8.3%
Nation Inventory of Architectural Heritage (NIAH)	8.3%
Public Lighting	8.3%
Trees	8.3%
Seats & Beaches	8.3%
Public Green Space	8.3%
Public Allotments	8.3%
Noise	8.3%
	100%

Table 11 Public Realm attribute equal weighting

The Equal Weighting method fosters a comprehensive evaluation of the public realm, considering urban residents' diverse needs and preferences. It acknowledges that the quality of public spaces plays a crucial role in enhancing cities' overall liveability and attractiveness. By assigning equal importance to each attribute, it promotes the creation of inclusive, well-designed, and accessible public areas that contribute to the overall urban quality.

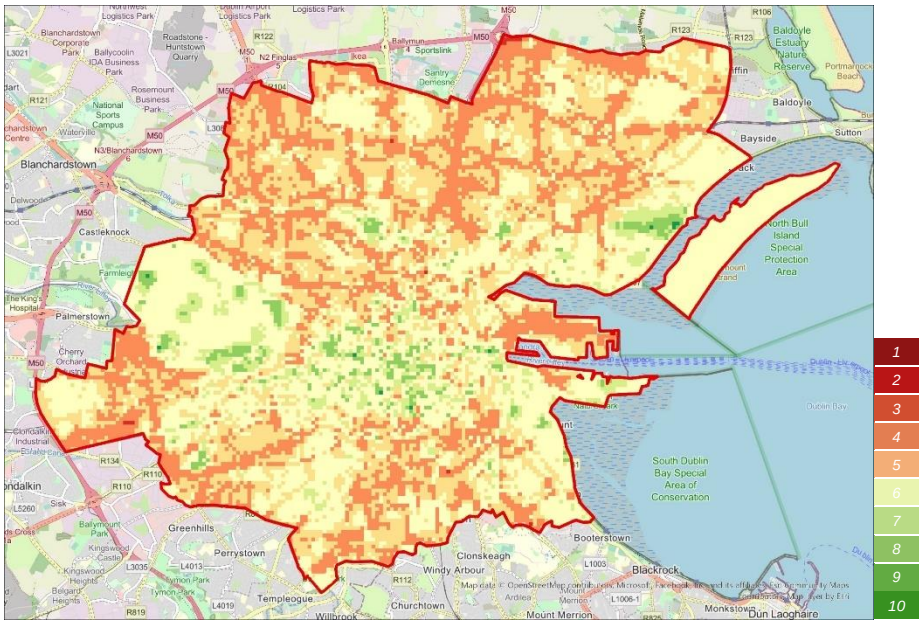


Figure 31 Public Realm Data Overlay

Figure 30 displays a map that depicts how the public realm is distributed in the study area. There are moderate values spread out throughout the study area, but only some areas have values greater than 7. The city centres perform better overall with pockets of values unevenly distributed with the canals, with a grouping of values greater than seven located northwest of the study area towards the coastline.

Stage 5 & Stage 6 employs the Equal Weighting approach and the application of the Weighted Overlay function in ArcGIS to define each attribute's weight and illustrate this weighting in a cartographical form. Using an Equal Weighting method, the evaluation framework ensures that no attribute is undervalued or overlooked.

4.5.6 Stage 7: Review

The final stage of this Phase entails the superimposition of Accessibility, Services & Social Infrastructure, and Public Realm maps produced in Stage 5&6. As part of the review, we will introduce multiple scenarios, including our baseline Scenario, which equally weighs the characteristics of urban quality. Scenarios 2, 3 and 4 and their weights are outlined in Table 12 below.

Characteristic	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Accessibility	33.3%	50%	25%	25%
Services & Social Infrastructure	33.3%	25%	50%	25%
Public Realm	33.3%	25%	25%	50%
	100%	**100%**	**100%**	**100%**

Table 12 Urban Quality Characteristics Weighting Scenarios

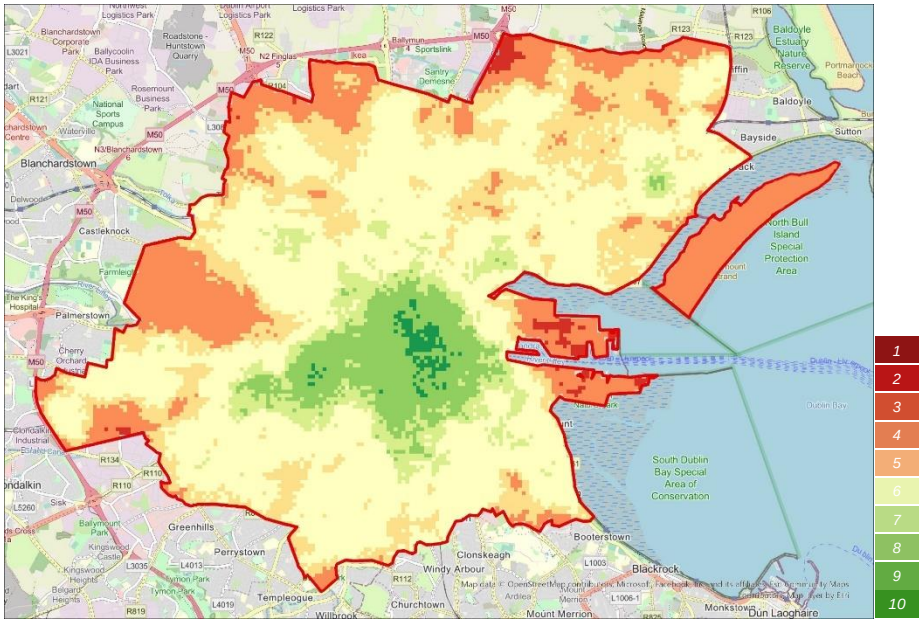


Figure 32 Scenario 1: Urban Quality Data Overlay Map

Scenario 1 shows that the value of urban quality is very much concentrated in the city centre of the DCC study area with few exceptions. As the characterises are equally weighted, it illustrates the significate concentration of accessibility, services & social infrastructure, and public realm in the city centre with a significant number of high-value areas immediately north and south of the geographical centre. It must be noted the cluster of high-value urban quality emerging in the Northeast; this area is subject to a high value in both the public realm through the proximity to St Anne's Park and high-value accessibility due to the Irish Rail stop at Harmonstown.

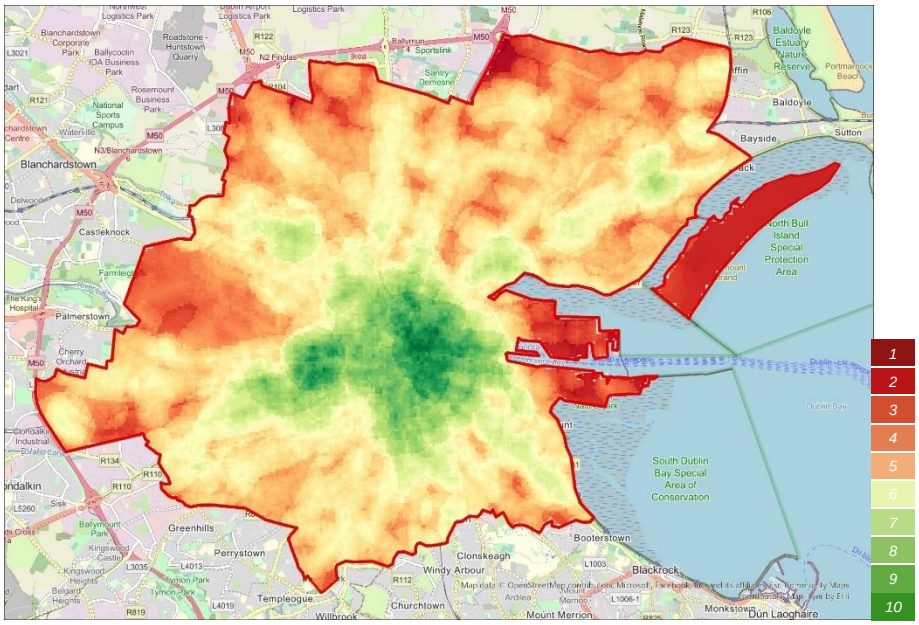


Figure 33 Scenario 2: Urban Quality Data Overlay Map

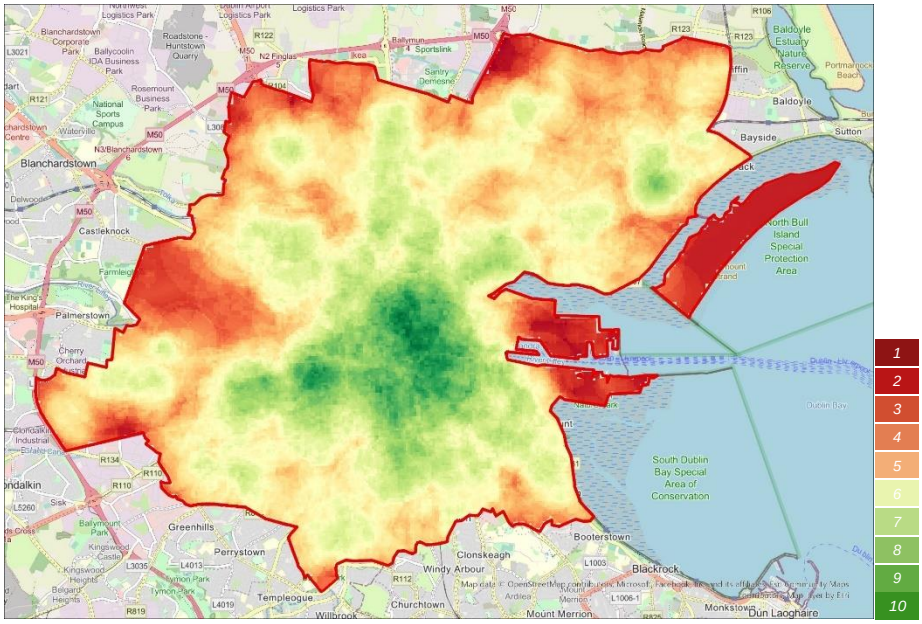


Figure 34 Scenario 3: Urban Quality Data Overlay Map

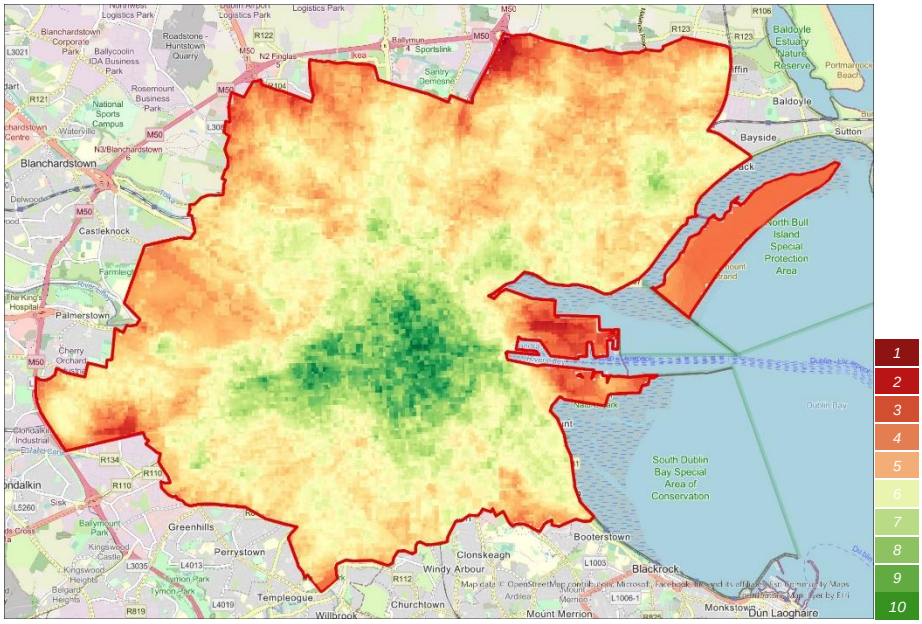


Figure 35 Scenario 4: Urban Quality Data Overlay Map

The above communicates the sensitivity of the weighting on each characterising informing urban quality. Scenario 2 (Fig 33) displays a widening of high-value areas along key accessibility routes moving towards the city centre. It generates a clustering of value around an accessible city centre. Scenario 3 (Fig 34) shifts the weighting towards services & social infrastructure. The pattern of high-value areas broadens and is more expansive than Scenario 2, illustrating a more significant disbursement of services than means of accessibility. The final sensitivity analysis, Scenario 4 (Fig 35) illustrates the concentration of attributes pertaining to the positive public realm in the city centre. It is interesting not to observe a greater influence of underlying coastal features.

All further analysis from the point onwards will be conducted upon Scenario 1.

4.6 PHASE 2: HEDONIC PRICING MODEL

4.6.1 Stage 8: Model Preparation

In this stage, the Multi Values to Points function conducts much of the preparation in ArcGIS Pro. The function is applied to the previous stage's outcomes, where each aggregated map is related to the Accessibility, Social Infrastructure & Services and Public Realm. The values attributed to each cell are associated with each property observation. The Multi Values to Points function automatically creates a new field in the attribute table of the property observation shapefile, donating the value of accessibility, social infrastructure & services, public realm, and urban quality to each property observation. At this point, the property observation is exported from the GIS environment into Excel. In Excel, the property observations are analysed to ensure accuracy and sense checks against the outcome of the previous stages. Any data, such as those that may endanger the outcome of the next stage, are removed. These may include property observations in which the Multi Values to Points function failed to allocate a value; thankfully, this occurred negligibly. At this point, the data in .csv format is ready to be introduced to the SPSS environment.

4.6.2 Data

The property price data were web scraped from Daft.ie in October 2022, Ireland's largest property sales website. The dataset consists of a representative sample of residential properties on the market in the DCC Area. This amounts to just over 2,000 dwellings. The complete addresses were used, along with the national database of buildings of Ireland, to geo-code the data. Not all addresses in the original database were amenable to geocoding via ArcGIS Pro. Our valid sample size after geo-coding was 1,476, covering most of the Dublin City area (see Fig 36). In Fig 37 an analysis of pricing on an price per sqm is presented.

The available property-related attributes/variables are the following:

Price (€)
Price (€) per sqm
The floor space (measured in square metres)
The number of bedrooms
The number of bathrooms
Type of dwelling (apartment, bungalow, detached, duplex, end of terrace, semi-detached, terrace, townhouse).

Table 13 Available Property-Related Attributes/Variables

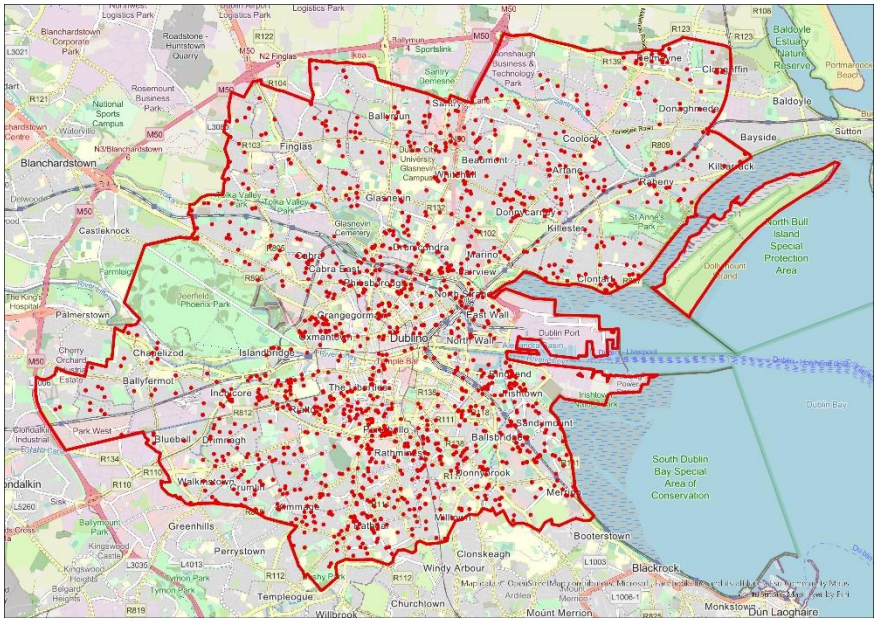


Figure 36 Map of Residential Property Observations

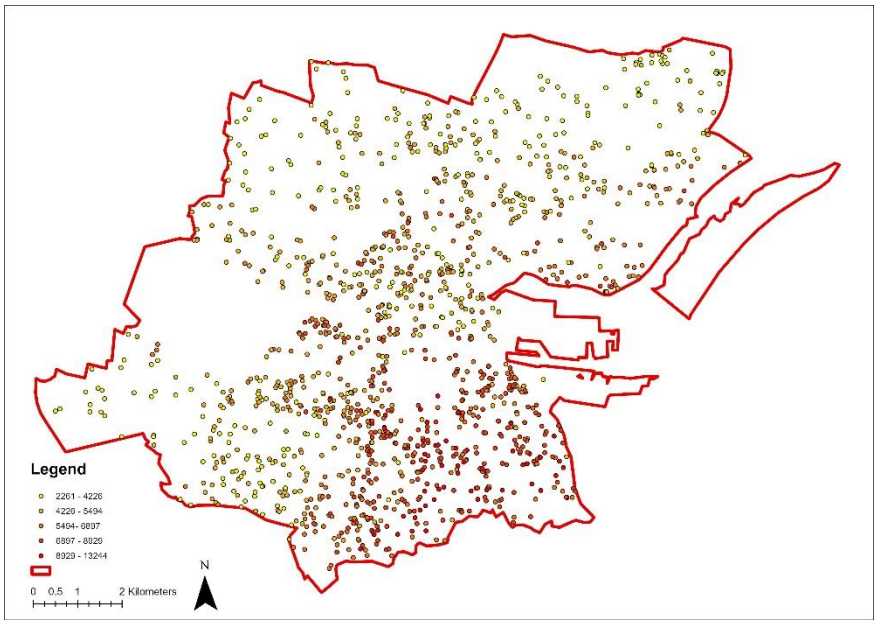


Figure 37 Residential Property Observations Price Per Sqm

4.6.3 Stage 9: Valuation

The primary objective of this Stage is to construct an Ordinary Least Squares (OLS) regression model, commonly employed in hedonic pricing analysis through SPSS, to estimate the impact of various dwelling characteristics, including Urban Quality, on property prices. By employing this methodology, we aim to determine the implicit value associated with each characteristic and understand how these factors collectively contribute to the final price of a property. Table 14 provides detailed data in this hedonic pricing model, forming the basis for hedonic pricing model.

Variables	Description	Value	ID	Measure
$\boldsymbol{P_x}$	Guide price of the property at the time on the market	Price in €	Price	Scale
$\boldsymbol{P_1}$	Guide price of the property per square metre	Price Per Sqm in €	Price Per Sqm	Scale
$\boldsymbol{x_1}$	The floor area	In square meters	Area	Scale
$\boldsymbol{x_2}$	The number of bedrooms	Numbers	n_bed	Nominal
$\boldsymbol{x_3}$	The number of bathrooms	Numbers	n_bath	Nominal
$\boldsymbol{x_4}$	Type of dwelling (apartment, bungalow, detached, duplex, end of terrace, semi-detached, terrace, townhouse).	Numbers (Desirability) (Scale 1, being apartment the lowest value – 10 being detached being the highest value)	value_type	Scale
$\boldsymbol{l_1}$	Dublin Area Code	Numbers (Dublin 1, Dublin 2, Dublin 3…etc)	value_area_code	Ordinal
$\boldsymbol{n_1}$	Accessibility	Numbers (Scale 1, being the lowest value – 10 being the highest value)	value_ accessibility	Ordinal
$\boldsymbol{n_2}$	Services & Social Infrastructure	Numbers (Scale 1, being the lowest value – 10 being the highest value)	value_sis	Ordinal
$\boldsymbol{n_3}$	Public Realm	Numbers (Scale 1, being the lowest value – 10 being the highest value)	value_publicrealm	Ordinal
$\boldsymbol{n_4}$	Urban Quality	Numbers (Scale 1, being the lowest value – 10 being the highest value)	value_urbanquality	Ordinal

Table 14 Regression Dataset

When deciding which dependent variable to use, there is a consideration of whether to use the Price $\boldsymbol{P_x}$ or Price Per Sqm P_1. Typically, the overall price is chosen when the exact size of the dwelling is unknown. However, using the overall price as a substitute for size may yield a better fit for the model, as a significant portion of price differences can be readily explained by size. On the other hand, using price per square meter may simplify the model by removing certain non-linearities.

4.6.3.1 Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation	N
price	149950	6750000.00	629533.02	613931	1476
price_per_sqm	2261	13244.00	5580.21	1769	1476
area	30	595,00	108,49	70	1476
N_bed	1	11,00	2,84	1	1476
N_bath	1	10,00	1,81	1	1476
value_type	1	8,00	4,58	2	1476
value_area_code	1	18,00	7,61	4	1476
value_accessibility	1	10,00	4,20	2	1476
value_ssi	1	10,00	6,32	2	1476
value_publicrealm	1	10,00	4,45	1	1476
value_urbanquality	1	10,00	5,80	2	1476

Table 15 Descriptive Statistics

The final dataset consists of nine variables whose descriptive statistics are presented in Table 15. According to the data, an average property rented in Dublin has a floor area of 108.49 square meters[1]. While the average price for such a property equalling €629,533, the variable price is characterised by its wide range with a minimum of €149,950, a maximum of €6,750,000 with a standard deviation of €613,931. A property-related variable that draws attention is the variable 'N_bed' which has a mean value of 2.84 bedrooms. At the same time, the standard deviation of 1 indicates the variability in bedroom counts. For those neighbourhood related variables produced as part of this research, the mean illustrates that more than half of N has 'value_accessibility' and 'value_publicrealm' values less than five at 4.20 and 4.45, respectively. 'Value_ssi' has the most robust mean value at 6.32. This may signify a higher degree of services and social infrastructure at the utility of each observation. Finally, the 'value_urbanquality' presents a minimum of 1 and a maximum of 10 with a mean of 5.80, illustrating that more than half of N have utility >5 regarding urban quality.

[1] During the analysis, it was observed that the independent variable "area" had a negative impact on the hedonic pricing model. As a result, the author has decided to exclude it from any further analysis, including the regression.

4.6.3.2 Pearsons Correlation

Variable	price	N_ bed	N_ bath	value_ type	value_ area_code	value_ accessibility	value_ ssi	value_ publicrealm	value_ urbanquality
price	1,00	.578**	.606**	.280**	-.272**	0,00	0,01	-.067*	0,00
N_bed	.578**	1,00	.676**	.496**	-.053*	-.187**	-.084**	-.166**	-.179**
N_bath	.606**	.676**	1,00	.220**	-.110**	-.059*	-0,04	-.101**	-.070**
value_type	.280**	.496**	.220**	1,00	.066*	-.319**	-.136**	-.174**	-.278**
value_area_code	-.272**	-.053*	-.110**	.066*	1,00	-.305**	-.314**	-.164**	-.373**
value_accessibility	0,00	-.187**	-.059*	-.319**	-.305**	1,00	.415**	.139**	.793**
value_ssi	0,01	-.084**	-0,04	-.136**	-.314**	.415**	1,00	.183**	.757**
value_publicrealm	-.067*	-.166**	-.101**	-.174**	-.164**	.139**	.183**	1,00	.406**
value_urbanquality	0,00	-.179**	-.070**	-.278**	-.373**	.793**	.757**	.406**	1,00

Table 16 Pearsons Correlation

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)
_. of relevance to this investigation

The Pearson Correlation reveals interesting insights about the relationships between property Price P_x and the selected variables. The number of bedrooms also exhibits a positive and moderate correlation (0.578**), indicating that properties with more bedrooms tend to have higher prices. Similarly, the number of bathrooms shows a positive and moderate correlation (0.606**). On the other hand, the type of dwelling has a positive but weak correlation (0.280**), suggesting that certain types of dwellings may slightly impact prices. The attractiveness rating of the area has a weak negative correlation (-0.272**) with Price P_x , implying that less attractive areas may be associated with lower prices. Accessibility, Services and Social Infrastructure, and Public Realm do not show significant correlations, except for a weak positive correlation (0.01) between Services and Social Infrastructure and the Price P_x . Lastly, there is no significant correlation between the Urban Quality and the Price P_x .

4.6.3.3 Regression

The dependent variable Price P_x was regressed on the predicting independent eight variables detailed above. The independent variables in the model significantly predict property Price P_x**,** *F* (8, 1467) = 162, p < .001 which indicates that the selected independent variables in this investigation significantly impact property Price P_x. Moreover, the adjusted R^2 = 0.467 depicts that Model 1 explains 46.7% of the variance in Price P_x. Additionally, coefficients were further assessed in Table 17 to ascertain the influence of each of the independent variables on the dependent variable Price P_x.

	Unstandardised Coefficients		**Standardized Coefficients**	
Variable	**B**	**Std. Error**	**Beta**	**P.**
N_bed	137238.054	14990,323	0,271	0,00
N_bath	221869.128	15334,431	0,381	0,00
value_type	22853.016	6210,353	0,085	0,00
value_area_code	-35993.147	3470,289	-0,216	0,00
value_accessibility	10229.717	14173,186	0,030	0,47
value_ssi	-11550.622	13626,818	-0,031	0,40
value_publicrealm	-5123,143	12695,236	-0,010	0,69
value_urbanquality	7938,266	25185,139	0,019	0,75
	R^2	Adjusted R^2		
	0,470	0,467		

Table 17 Regression Analysis

The results of the linear regression analysis revealed several significant findings. Firstly, the coefficient for the number of bedrooms (N_bed) was €137,238 (p < 0.001), indicating a significant positive relationship with Price P_x . This suggests that properties with more bedrooms tend to command higher prices. The standardised coefficient (Beta) of 0.271 further supports this finding, indicating a moderate effect size. Similarly, the coefficient for the number of bathrooms (N_bath) was €221,869 (p < 0.001), indicating a significant positive association with Price P_x. Properties with more bathrooms tend to have higher prices, as supported by the relatively strong standardised coefficient (Beta = 0.381). This illustrates the property-related variables tend to be a significant determinant of value. Additionally, the type of dwelling (value_type) was found to have a significant positive impact on Price P_x, with a coefficient of €22,853 (p < 0.001). The standardised coefficient (Beta = 0.085) suggests a small effect size. On the other hand, the area code (value_area_code) exhibited a significant negative relationship with Price P_x, as indicated by the coefficient of -€35,993 (p < 0.001). This implies that when a property moves from area code Dublin X to Dublin Y, starting at 1, tends to have an adverse effect on Price P_x.

As for those independent neighbourhood related variables constructed during this investigation, the coefficient for value_accessibility is €10,229 (p = 0.47), indicating that accessibility does not significantly impact Price P_x. This suggests that variations in accessibility levels do not lead to significant differences in Price P_x. The standardised coefficient (Beta) of 0.030 indicates a minimal effect size, further supporting the lack of substantial influence. Similarly, the coefficient for value_ssi is -€11,550 (p = 0.40), indicating that the satisfaction rating of services and social infrastructure does not have a statistically significant impact on Price P_x. The standardised coefficient (Beta) of -0.031 suggests a small effect. Therefore, the data does not provide sufficient evidence to conclude that the satisfaction rating significantly affects property prices. Furthermore, the coefficient for value_publicrealm is -€5,123 (p = 0.69), suggesting that the quality rating of the public realm does not have a statistically significant influence on predicted prices. The standardised coefficient (Beta) of -0.010 indicates a minimal small effect, supporting the lack of significance. Lastly, the focal point of this study is the coefficient for value_urbanquality is €7,938 (p = 0.75), indicating that the urban quality rating does not have a statistically significant impact on Price P_x.The standardised coefficient (Beta) of 0.019 suggests a nominal determinate on Price P_x.

5 CHAPTER 5: FINDINGS AND CONCLUSION

5.1 FINDINGS

- From an academic perspective, there is growing consensus that urban quality is a complex and dynamic concept encompassing a range of interrelated physical, social, economic, and environmental factors.
- There is an absence of an urban quality taxonomy and assessment tool for the Irish context, which creates issues for those investigating urban quality as they must distil a multitude of taxonomy and tools from other often incomparable contexts to define urban quality.
- Under the Dublin City Development Plan, accessibility, services & social infrastructure, and the public realm in the context of Dublin pertain to the city's general liveability and quality of life.
    - The Plan acknowledges the pivotal role of urban quality in fostering healthy and sustainable communities and underscores the significance of providing and enhancing these facilities across the city.
    - The Plan illustrates its commitment by introducing policies and Objectives to deal with issues relating to improving urban quality.
- In creating an SMCA and producing urban quality value maps, the baseline scenario illustrates that urban quality is very much concentrated in the city centre of the study area with few exceptions. As the characterises are equally weighted, it illustrates the significate concentration of accessibility, services & social infrastructure, and public realm in the city centre with a significant number of high-value areas immediately north and south of the geographical centre.
- The hedonic pricing model revealed that property-related variables such as the number of bedrooms and bathrooms exhibited a significant positive relationship with property prices. Properties with a greater number of bedrooms and bathrooms tended to command higher prices, emphasising the importance of these factors in the housing market. The type of dwelling was found to have a significant positive impact on property prices, indicating that certain dwelling types are more desirable and, consequently, more valuable.
- As for location-related variables, the area code exhibited a significant negative relationship with property prices. Transitioning from one area code to another within Dublin was associated with decreased property prices, suggesting the presence of spatial disparities in housing values. This finding underscores the influence of location on property prices and highlights the heterogeneity of the Dublin housing market.
- Neighbourhood-related variables derived from this investigation, we find that accessibility, as defined by the SMCA and regressed as part of the hedonic pricing model, incurs a premium of 3% with an increase in property prices of €10,229. The same cannot be ascertained by Services and Social Infrastructure and Public Realm, and both tend to incur a negative pricing impact on property prices, with the value of Services and Social Infrastructure decreasing property prices by €11,550 or 3.1% and the value of Public Realm decreasing property prices by -€5,123 or 1.0%.
- Urban quality, the focal point of this investigation has an insignificant correlation to property prices while exhibiting a positive, albeit again insignificant, coefficient. Nevertheless, the

premium associated with having increased urban quality tends to be 1.9% with an increase in property prices of €7,938.

5.2 Conclusion & Further Studies

Although this work has made progress in determining its origins, essential questions remain unanswered. Additionally, as the research approached its conclusion, it uncovered new avenues for exploration that require independent investigation to understand better how urban quality impacts residential property prices in Dublin.

First, the development of comprehensive urban quality taxonomy and assessment tools tailored to the Irish context. A native taxonomy or assessment tool would aid those seeking to analyse urban quality in an Irish context with a platform instead of relying on taxonomies and tools from other jurisdictions and spatial contexts.

Secondly, the status quo of home ownership is currently being challenged in Ireland. It is appropriate to analyse the effect of urban quality on rental prices and the rental market dynamics. From the author's perception, this may yield contradictory findings to this study due to the desires and objectives of renters often being at odds with homeowners.

Thirdly, consideration should be to the temporal aspect of urban quality by investigating how its effects on property prices may change over time and in response to various economic and policy factors. This will allow an analysis of if the conditions of urban quality improve, should this positively impact property prices.

Fourthly, and associated with the previous conclusion and suggestion, is the assessment of the marginal cost of improving urban quality and how this cost is weighted against improving urban quality.

Finally, Dublin is not Ireland's only local authority, region, or administrative jurisdiction. An exploration through comparative studies to understand the differences and similarities in urban quality effects on property prices across different cities or regions within Ireland.

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