

An Urban Morphology Analysis of  
Urban Innovation Districts in Canada

by  
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## **AUTHOR'S DECLARATION**

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

## **ABSTRACT**

Since the economic transition towards a knowledge-based economy in the 1990s, technological innovation has been an essential driver of economic growth and development. As a reaction to such phenomena, Urban Innovation Districts (UIDs) are becoming a new urban strategy used to raise a city's innovation profile. The concept of UIDs is one of the most recent developments within an extensive collection of literature on the rise of the creative economy, creative classes, and the clustering of creative industries in urban areas. However, academic research on UIDs has focused on their economic implications but fail to analyze them physically.

The following research question drove this study: “What are the place characteristics that distinguish UIDs, and how does urban morphology influence the formation of such characteristics?”. This study addressed the concerns of many writers and scholars in terms of the lack of form and space quality in local development plans. Thus, it became important to evaluate and investigate the relationship between physical urban form and the characteristics of a place. A broad body of literature in the field suggests that the industries associated with UIDs are sensitive to the characteristics of a place. Several studies have proved that high tech and start-up activities are shifting toward mixed-use, transit-oriented, walkable urban centres.

This study employed multiple-case studies as an explanatory tool to describe how place characteristics of UIDs — compactness, mixed-use development, and connectivity — were influenced by morphological elements of an urban form. This study analyzed and compared UIDs across Canada using a morphological method known as the “British School”, along with the scientific approach to investigate urban form empirically.

The principal value of this study was its comparative nature. Through the analysis of multiple-case studies, it developed a sharpened understanding of the concept of UIDs in the Canadian context; not only as a branding initiative, but as a thriving urban strategy that creates an attractive urban fabric promoting economic growth and social interaction. This study also contributed to forging a better theoretical and conceptual understanding of how urban morphology could be incorporated into the placemaking process by revealing how physical form affected the characteristics of a place.

*Key words: Urban Innovation Districts, urban morphology*

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## **OPERATIONAL DEFINITIONS**

**COMPACTNESS:** the quality of being closely packed together in a small space – often characterized by high-density, mixed-use, and reuse of brownfield land (Burton, 2002).

**CONNECTIVITY:** cities’ and citizens’ network organization, connectedness, and circulation. Connectivity is defined as the available alternative ways between spaces or buildings (Handy et al, 2002: 66).

**DENSITY:** one of the common characteristics used in measuring the compactness of urban form in studies (for example, Kotharkar et al., 2014; Burton, 2002; Coorey & Lau, 2005). In the context of Urban Innovation Districts, density is known to play a crucial role in innovation and the flow of ideas by increasing the ease and frequency of social interaction within a district (Storper & Venables, 2004; Wood & Dovey, 2015). The density of Urban Innovation Districts (UIDs) does not only refer to the conventional urban density but to the concentration of resources- including human capital and economic and physical assets- in one place.

**INNOVATION DISTRICTS (IDs):** one of the small pockets of growth in a town or city where scientists, entrepreneurs, investors, and corporate partners collaborate in unexpected ways. They are “geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators” (Katz & Wagner, 2014, p. 1). These areas are “physically compact, transit-accessible, and technically-wired and offer mixed-use housing, office, and retail” (Katz & Wagner, 2014, p.1).

**MIXED-USE DEVELOPMENT:** diversified urban form providing essential services to residents and workers in the district (i.e. housing, office, and retail). Mixed-use development activates streets and the public inviting a mix of people to shop, browse, and mingle, reflecting contemporary urban consumption patterns of the new economy (Hutton, 2010).

**PERMEABILITY:** a measure of the movement opportunity in an environment allowing people the option of different routes through and within it (Carmona, Heath, Oc, & Tiesdell, 2010).

**PLACE:** a space with a distinct characteristic, while space is considered to be more abstract and impersonal (Norberg-Schultz, 1980). Place is identified as having meaning and value (Madanipour, 2010, p. 6).

**URBAN INNOVATION DISTRICTS (UIDS):** IDs occurring in mixed-use, transit-oriented, walkable urban centres. They re-emphasize Jane Jacob's vision of the importance of the urban community. UIDs are leading entrepreneurship and commercialization, triggering forward-thinking municipalities around the world to rethink the innovation model once exemplified by Silicon Valley (White, 2016).

**URBAN MORPHOLOGY:** the study of human settlement. It examines the built-form of cities. It seeks to explain the layout and spatial composition of urban structures and open spaces (Conzen, 2012), and reveal how various physical components relate to each other in a system (Vance, 1990).

**WALKABILITY:** a key urban design concept in the study of street life intensities and transit-oriented urbanism (Cervero & Kockelman, 1997; Krizek, 2003; Lo, 2009). Walkability is related to many aspects of the urban environment such as permeability, land use mix, and density (Porta and Renne 2005; Moudon et al. 2006; Forsyth et al. 2008; Ewing and Handy 2009; Lin and Moudon 2010; Lee and Talen 2014).

*“INNOVATION DISTRICTS  
EMBODY THE VERY ESSENCE OF CITIES:*

*AN AGGREGATION OF TALENTED, DRIVEN PEOPLE,  
ASSEMBLED IN CLOSE QUARTERS,  
WHO EXCHANGE IDEAS AND KNOWLEDGE  
IN A DYNAMIC PROCESS OF  
INNOVATION, IMITATION, & IMPROVEMENT.”*

*-Peter Hall*

*the author of *Cities in Civilization: Culture, Innovation, and Urban Order* (1999)*

# CHAPTER 1

## INTRODUCTION

---

### 1.1 RESEARCH PROBLEM

Cities are increasingly becoming one of the primary drivers to stimulate technological innovations (Castells, 1996; Florida, Adler, & Mellander, 2017). Technological innovation drives economic growth, as well as the quality and quantity of jobs improving standards of living (OECD, 2011). Rising concerns with the prosperity of the city and its ability to attract jobs and investment, Urban Innovation Districts (UIDs) are becoming an essential urban strategy to raise a city's innovation profile. By raising their innovation profile, cities are seeking to accommodate leading edge institutions and a new generation of technology-powered companies whose innovation model depends on proximity, and talent pool explicitly prefers urban locations and lifestyles (Clark, Moonen, & Peek, 2016).

UIDs are a recent trend in urban planning that have emerged since the late 1990s as a new urban model to be more competitive through strengthening its economic growth in the transition towards a knowledge-based economy (Clark et al., 2016; Morisson, 2015; Katz & Wagner, 2014; Talkington, 2014; Clark, 2010). This transition in the economy is changing the geography of innovation, making municipal governments around the globe rethink the innovation model exemplified by Silicon Valley (Ovacevski, 2018, White, 2016). Utilizing downtown density as the driving force, UIDs are becoming the leading engines for entrepreneurship and commercialization. In UIDs, an entire innovation ecosystem - scientists, entrepreneurs, investors, and

corporate partners - turns up for work every day to collaborate in unexpected ways (White, 2016). UIDs gather leading edge anchor institutions and companies to cluster and connect with start-ups, business incubators, and accelerators. UIDs not only attract and retain economic assets, such as entrepreneurs and innovative companies, but they also revitalize neglected parts of the city (Morisson, 2015; Katz & Wagner, 2014; Glaeser, 2009; Clark, 2010).

The concept of UIDs is a popular buzzword to rebrand and revitalize inner-city neighbourhoods around the world (Morisson, 2015; Katz & Wagner, 2014). Revitalizing neglected urban neighbourhoods with a branding initiative, such as UIDs, hints the potential of place branding as a tool in city planning. Well-executed place branding is known to build imaginative and passionate relationships with a place by enhancing aspects of physical components, such as image, assets, condition, and personalities, of a place (Balducci, Fedeli, and Pasqui, 2011).

The concept of UIDs combines various urban theories (Morrison, 2014). Marshall (1890) noted that industry-clustering offers economic advantages, and Jacobs (1969) later added that innovation relies on the spillover of ideas. Jacobs' (1961) urban theory on mixed-use is critical in understanding UIDs. She believed that the retention of old buildings promotes an architectural mix. Further, she noted that various building types and sizes allow for diversified mixed land-uses and activities, leading to more permeable and active urban street life. From an economic perspective, Porter (1990) claims that inter-personal networks in industrial clusters drive innovation, increasing its economic competitiveness. The triple helix model of innovation proposed by Leydesdorff and Etzkowitz (1995) emphasizes the interactions between academia, industries and governments to foster economic and social innovation.



UIDs promote a compact and accessible urban form offering mixed-use housing, offices, and retail stores. The physical form of UIDs creates a sense of intimacy and coziness; with increased walkability within pedestrian-friendly streetscapes creating the feel of an *urban village* (Hutton, 2006). Within the aforementioned literature, it is acknowledged that innovation relies on spillovers between different industries (Marshall, 1890; Jacobs, 1969), and the quality and characteristics of a place are a vital aspect for the success of such clustering (Katz & Wagner, 2014; Wood & Dovey, 2015). Density plays a crucial role in innovation and the flow of ideas (Storper & Venables, 2004; Wood & Dovey, 2015). The density of UIDs does not only refer to the conventional urban density, but the concentration of resources - including human capital, and economic and physical assets - in one place. Density encourages knowledge spillover by increasing the ease and frequency of face-to-face interaction within the district.

Urban form and UID programs include mixed-income housing, smaller and affordable spaces for start-ups, and flex workspaces. As a result, UIDs are filled with amenities - such as medical offices, grocery stores, restaurants, cafes, small hotels, and local retail stores (bookstores and clothing stores) - located within walking distance through open spaces. They also feature more walkable streets surrounded by repurposed historical or former industrial buildings. Such densely networked urban environments activate streets and public spaces, inviting a mix of people to shop, browse, and mingle (Hutton, 2010). A high level of interactivity between nodes within a network makes UIDs a place where relations of trust can develop (Katz & Shapiro, 1985; Liebowitz & Margolis, 1994).

This paper negated the lack of a systematic analysis of UIDs (Katz & Wagner, 2014).

The current studies of UIDs focus on their economical implications, but lack in the physical analysis of place. Therefore, this study focused on the common physical attributes of UIDs; physical assets of UIDs to buildings, open spaces, and streets that support and encourage connectivity, collaboration, and innovation. The research challenges that UIDs are not only a branding initiative, but a solid urban strategy that can create synergy between economic, physical, and network assets of the city.

## 1.2 RESEARCH QUESTION

The inspiration for this study stemmed from the author's interest and inquiry of "What makes a good place?". As the author's understanding of place expanded - by studying the Landscape + Urbanism program - personal curiosity and the pursuit of making and designing a good place grew. By choosing to pursue a graduate degree in Planning, one of the goals was to understand how the planning and designing of urban spaces was not only a political and economic procedure, but a critical cultural act that has an immense impact on everyday life.

The vague personal inquiry of "What makes a good place?", became clear when the author learned about the concept of UIDs. UIDs are chosen as an ideal medium to explore such an inquiry, as they are urban forms that share a set of desirable place characteristics.

As a result, the problem and inquiry are formulated into the following main research question to include the topic of exploring the urban morphology of UIDs into an area more suited for academic research.

*What are the place characteristics that distinguish UIDs, and how does urban morphology influence the formation of such characteristics?*

More specifically, the research investigates the urban morphology of UIDs in the Canadian context. First, the research identifies the place characteristics of UIDs. Second, the research investigates the morphological characteristics of UIDs, aiming to provide insights into how physical attributes of UIDs create a favourable environment for innovation.

### 1.3 RESEARCH OBJECTIVE

The objective of this study was twofold. Firstly, to explore the urban morphology of UIDs in Canada. Further, the second objective of this study was to explore the potential of integrating urban morphology to improve planning and place-making practices.

Ultimately, the author hoped that the findings of the study would be applicable and useful to practitioners who create and manage urban spaces. In order to achieve its objectives, the research paid particular interest to UIDs in the Canadian context. The research aimed to develop a theoretical framework to better understand the concept of UIDs not only as a branding initiative, but as a thriving urban strategy; creating an attractive urban fabric that promotes economic growth and social interaction.

## **CHAPTER 2**

### LITERATURE REVIEW

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## 2.1 INTRODUCTION

This section of the study examined literature surrounding the topics of Urban Innovation Districts (UIDs) and urban morphology. Reviewing the literature for each topic laid foundational knowledge and sought to identify variables within UIDs.

This chapter will discuss the emergence of UIDs as a new urban strategy. It also revisits the well-documented shift of landscapes becoming compact and amenity-rich enclaves in the core of cities. It will then discuss the morphological elements of UIDs in terms of their characteristics and assets. It pays particular attention to how physical attributes of UIDs create a favourable environment for innovation. The literature review briefly introduced the concept of place-branding and how it is applied to UIDs.

The result of the literature review was the identification of place characteristics of UIDs and establishing a conceptual research map and theoretical framework. The theoretical framework will be further developed in the Methodology chapter to explore how identified place characteristics of UIDs were affected by morphological elements.

## 2.2 URBAN MORPHOLOGY

### ***UNDERSTANDING URBAN MORPHOLOGY***

Le Corbusier (1933) stressed that “city planning is a three-dimensional – rather than a two-dimensional – science (p. 198)”. The lack of form and space quality in local development plans and the enduring two-dimensional land-use paradigm in planning is still one of the significant problems for many concurrent planning systems (Hall, 2008). Increased socio-spatial and political complexity in the planning — from the emergence of systems planning in the late 1950s, to contemporary planning approaches such as advocacy, strategic, and environmental planning (Klosterman, 1985), and social policy perspectives (Davidoff, 1965) — resulted in the disconnection between planning and the normative theories of urban form that mainly considered the physical nature of human settlements (Talen & Ellis, 2002).

Urban morphology is an emerging field of study in urban planning. Urban morphology refers to the study of city forms focusing on patterns and processes of growth and change (Gauthier & Gilliland, 2006). It examines the configuration of urban form and space, and the spatial pattern of the infrastructures that support it (Vance, 1990). Urban morphology examines a city’s street pattern, urban blocks, the spaces between buildings, land-uses, and the changes in urban form over time. The focus of urban morphology is how the urban fabric can create identifiable spaces over time –bridging the divide between planning geography, and architecture (Whitehand, 2009).

Three schools are contributing to the field of urban morphology. The three schools are known as the British school, the Italian school, and the French school. Developed

in the 1960s, the British school (also known as the Conzenian perspective) focuses on the conceptualization of urban form development centred around the planned unit. The planned unit is formed by the interrelatedness of elements of the street, parcel/lot, and building. Conzen (1960) categorized the urban fabric into elements of land use, building patterns, lot patterns, and street patterns. While Conzen provides a robust methodological framework for analyzing physical urban forms, his focus was on medieval European towns.

The study of Moudon (1986) Alamo Square neighbourhood in San Francisco, provides a North American framework to the British School. Moudon examined the land-use change in the Alamo Square neighbourhood in San Francisco from 1899 to 1976. She analyzed morphological elements of buildings and urban blocks, in addition to data points on habitation and business trends in the area over time. Moudon (1997) believed that “the city can be read and analyzed via the medium of its physical form (p. 5)”. Through an examination of urban fabrics, urban morphology bridges the gap between planning, geography, and architecture (Whitehand, 2009).

The Italian school (also known as Muratorian school) discusses how cities should be built (Lowry & Lowry, 2014). Two leading contributors are Saverio Muratori and Gianfranco Caniggia. It aims to develop a city design theory respecting historical city’s building traditions. The school’s studies categorize buildings into types; in their view, a city consists of Basic Types and Specialized Types. Their approach of morphological study uses a hierarchy system of the urban form. The scale for city’s and buildings is subdivided into four levels: elements, elements of structures, systems of structure, and organization of systems (Silva, 2015).

The French school emerged in the late 1960s in protest against modernist architecture. The school is known for its approach in differentiating the theory of design as an idea and the theory of design as practiced (Moudon, 1997).

Among these morphological schools, British school is compatible with the research aim for its descriptive, analytical and explanatory approach.

### ***MORPHOLOGICAL ELEMENTS***

Referred to as urban tissues, different patterns in streets, blocks, and lots, the arrangement of buildings within plots and, the shape of buildings can create very different urban environments (Caniggia & Maffel, 1979, 1984).

Although the stability of the elements varies depending on their context, buildings and land use are found to be the least resilient elements. Land uses are relatively temporary. They can be changed through redevelopment, amalgamation or subdivision of a plot, and changes in street pattern. Except for significant buildings – churches, cathedrals, and public buildings that are built with more significant investment (both financially and symbolically) – buildings only tend to survive if able to adapt to new land uses. For example, a Victorian single-family house could be converted into an office, then to multi-unit student housing. The lot pattern tends to be more enduring, but individual plots can be subdivided or amalgamated over time. Over time, lot boundaries may change as lots are bought and sold. Lots may be subdivided or amalgamated for larger developments. The most enduring morphological element is street pattern. Often developed over hundreds of years, the street pattern defines the urban block and provides a public space network

between those blocks. Important place qualities established by the street pattern are permeability and accessibility (Carmona, Heath, Oc, & Tiesdell, 2010).

Kropf (1998) suggested there are links between built forms and human activities, but the relationship is not fixed. Built forms tend to be stable over time, while activities within those built forms change more rapidly.

In her study of the Alamo Square neighbourhood, Moudon (1986) stated that successful urban environments are places that can accommodate the changing needs and desires of residents, without a significant change to the urban fabric. She claimed that urban blocks are “the basic cell of the neighbourhood fabric that establishes the pattern of the grain of the city and determines its scale (p. 144)”.

Urban tissues refer to the different patterns in an urban environment (Caniggia & Maffel 1979, 1984). They include differences in street and block patterns, plot patterns, the arrangement of buildings within plots, and the shapes of buildings (Carmona, Heath, Oc, & Tiesdell 2010, p.77). Further, the notion of tissue is better understood as a dynamic system (Carmona et al., 2010), where the concept of tissue, as Panerai et al. (2004, p.158) explained, evokes ideas of interweaving and connections between parts, together with a capacity for adaptation. It is in contrast to the complete or fixed, and instead implies a succession of transformations. In such, an investigation of urban precedents by comparing tissue helps to link the known to the unknown (Jenkins, 2008).



## 2.3 URBAN INNOVATION DISTRICTS

Urban Innovation Districts (UIDs) are small pockets of growth in a city where the scientists, entrepreneurs, investors, and corporate partners collaborate in unexpected ways. They are a place in which people and knowledge-based resources, such as research institutions, business incubators and accelerators, start-ups, and leading-edge anchor companies, are concentrated. These areas are “physically compact, transit-accessible, and technically-wired and offer mixed-use housing, office, and retail (Katz & Wagner, 2014, p.1).”

The concept of Innovation Districts (IDs) emerged for cities to become “Knowledge cities” by harnessing the transformative power of technological innovations. IDs combine innovation theories with the socio-economic trends of the knowledge-based economy, increasing the city’s spatial and urban dimensions (Morrison, 2014).

Economic transition in the 1990s towards post-Fordism or knowledge-based economies, has put technological innovation as a precondition for a high-standard of living and economic prosperity (Amin, 1994; Drucker, 1998; OECD, 1996). The Organization for Economic Co-operation and Development (OECD) (2015) claims that “innovation provides the foundation for new businesses, new jobs, and productivity growth and is thus an important driver of economic growth and development (p. 13)”. In a post-2008 era, characterized by low economic growth, innovation is considered as a transformative force in economic growth in both developed and developing economies (Metcalf & Ramlogan, 2008; OECD, 2015).

In need for sustainable economic growth and amid the economic transition toward

a knowledge-based economy, cities are branding themselves as the platform for innovation, entrepreneurship, and economic growth (Kelly, Ruther, Ehresman, & Nickerson, 2016). In reaction to such phenomena, IDs gather entrepreneurs, educational institutions, and start-ups “all connected by transit, powered by clean energy, wired for digital technology, and fueled by caffeine (Katz & Wagner, 2014, p. 2).” With the concentration of economic, social network, and physical assets, IDs promote mixed-use development, encourage sharing economy, and drive innovations (Stadshavens Rotterdam, 2015; Morisson, 2015; Katz & Wagner, 2014; Talkington, 2014; Clark, 2010).

### ***SOMETHING ‘IN THE AIR’***

The idea of the clustering of certain industries in urban neighbourhoods (like IDs) is not new. Marshall (1890) noted that industry clusterings have the economical advantages of a ready supply of labour, shorter distances along the production supply chain, and the mutual attraction of multiple competitors delivering to a large customer base.

Innovation relies on spillovers between different industries (Marshall, 1890; Jacobs, 1969) and the quality and characteristics of a place are vital aspects for such an environment (Katz & Wagner, 2014; Wood & Dovey, 2015). Marshall (1890) also noticed something in the air in such an environment – a certain *buzz* or *atmosphere* that permeates throughout industry clusterings that could not be quantified - promoting a spillover of tacit knowledge, based on frequent face-to-face interaction (Marshall, 1890). It is also widely noted that such districts have a certain buzz or atmosphere that permeates through them (Drake 2003; Storper & Venables 2004;

Currid and Williams 2010; Bohme 1993, 1998).

### ***ASSETS OF URBAN INNOVATION DISTRICTS***

Katz and Wagner (2014) analyzed IDs in terms of their assets. They believed that IDs uniquely contain three categories of assets: economic assets, physical assets, and network assets.

Economic assets of IDs are the firms, institutions, and organizations that drive and support an innovation-rich environment. Neighbourhood-building amenities providing essential services to residents and workers in the district are also considered economic assets. These amenities include medical offices, grocery stores, restaurants, cafes, small hotels, and local retail stores such as bookstores and clothing stores. They activate streets and public spaces in the district, inviting a mix of people to shop, browse, and mingle; reflecting contemporary urban consumption patterns of the new economy (Hutton, 2010).

Physical assets refer to buildings, open spaces, streets, and other infrastructures that exist in innovation districts. The physical assets and landscapes of districts are being re-imagined as a laboratory of innovation at the city-scale (Katz & Wagner, 2014). As an example, cities like Boston, Barcelona, Helsinki, and Seoul are incorporating innovation in their streetscapes and public spaces, testing new digital technologies in street lighting, waste collection, and traffic management solutions. Physical assets of IDs also include private buildings and spaces that support the innovation-driven demographic. These include mixed-income housing, smaller and affordable spaces for start-ups, and flex workspaces.

The networking assets refers to the relationships between actors of IDs that have the potential to generate and accelerate the advancement of innovative ideas. Katz and Wagner (2014) argued that IDs reach their potential when all types of assets combine to create a complete innovation ecosystem — “a synergistic relationship between people, firm, and place that facilitates idea generation and accelerates commercialization (p. 10).”

### ***INNOVATION DISTRICTS MODELS***

Katz and Wanger (2014) categorized IDs in the United States into three general models; these were *anchor plus*, *re-imagined urban areas*, and *urbanized science park*. This study borrowed Katz and Wanger’s categorization of IDs to analyze selected case studies in the Canadian context.

The anchor plus model is primarily found in the downtown and midtown areas, where massive scale mixed-use development is centred around major anchor institutions, entrepreneurs, and companies involved in the commercialization of innovation. Kendall Square in Cambridge, Philadelphia’s University City, midtown Atlanta, and downtown and midtown Detroit are examples of innovation districts that follow the anchor plus model.

The re-imagined urban area model draws inspiration from 22@Barcelona, which involves the complete re-model of an older industrial area in the city core (Pareja-Eastaway & Pique, 2011). These IDs are often found along historic waterfronts, where a former industrial district is undergoing a physical and economic transformation. Its proximity to downtown and the appeal of a historic building drives the regeneration

of the forgotten fabric of the city. Boston's South Waterfront, San Francisco's Mission Bay, and the Brooklyn Navy Yard are well-documented examples in the United States.

The urbanized science park model is found in isolated and sprawling suburban areas. In this model, areas of innovation are urbanized through increased density and an infusion of new activities, such as retail and restaurants. North Carolina's Research Triangle Park, one of the 20th century's most iconic research and development campuses, is the most robust validation of this model (Katz & Wagner, 2014). Since the 2000s, many scholars and practitioners have observed the emergence of IDs in urban environments close to downtown.

Acknowledging the geography of innovation is shifting toward the urban environment, the research paid closer attention to the models of *anchor plus*, and *re-imagined urban areas*.

### **GEOGRAPHICAL SHIFT IN INNOVATION**

Hutton (2004) observed a rise of new industrial clusters within the inner-city neighbourhoods in over seven global cities. He noted that these clusters constituted essential aspects of the spatiality of the *New Economy*. Bugliarello (2004) added that these urban clusters possessed increased density in a city providing public space or spaces for community activities. Florida (2014) validated the trend of shifting the geography of innovation through the mapping of venture capital activity by ZIP codes and area codes. His research shows that high-tech development, start-up activity, and venture investment are shifting to mixed-use, transit-oriented, walkable urban centres. It is also observed that the concept of UIDs has been applied to many

American and European neighbourhoods as a buzzword to rebrand an inner-city neighbourhood (Morisson, 2015).

Traditionally, IDs have been located in suburban corridors of isolated corporate campuses. These districts are often only accessible by car, with little emphasis on integrating work, housing, and recreation. The exemplary and iconic template for a thriving innovation district has been Silicon Valley. However, in recent years, the landscape of innovation is shifting to urban areas, with a rising number of innovative firms choosing to congregate and co-locate in compact and amenity-rich enclaves in the core of cities (see Table 1).

**Table 1. Comparing traditional innovation spaces and UIDs**

|                    | Traditional innovation spaces | Urban innovation districts   |
|--------------------|-------------------------------|--|
| <b>Context</b>     | Spatially isolated            | <ul style="list-style-type: none"> <li>▪ Embedded in the city</li> <li>▪ Re-imagined urban areas</li> <li>▪ Urbanized science parks</li> </ul> |
| <b>Sites</b>       | Greenfields                   | Brownfields  |
| <b>Functions</b>   | Research & commercial         | Mixed-use  |
| <b>Lay-out</b>     | Campus/sprawling corridor     | Physically compact   |
| <b>Main access</b> | Car                           | Public transit, walk, bike   |

*Based on Katz & Wanger (2014)*

As a new urban model and a branding tool, UIDs promote physically compact, transit-accessible, and technologically wired, mixed-used, live-and-work environments (Katz & Wagner, 2014). This new urban model aligns with Jane Jacob’s vision of the vibrant urban community that coexists in a dense environment to collaborate in unexpected ways (White, 2016).

The shift in tech industries also reinforces the change in innovation geography to the urban environment. Tech companies today thrive in an urban environment where they can connect with other industries as they are currently focusing on “applying technology to... advertising, media, fashion, finance, and health care” (Center for an Urban Future, 2012, p. 9) rather than building new technologies.

UIDs are a proven economic development model. UIDs leverage distinct economic strengths in each city, allowing for unique development varying in size, type, form, and density. Therefore, each UID presents different levels of institutional formality. For example, Boston’s South Waterfront is curated as an officially designated and branded place. In contrast, Kendall Park in Cambridge (Massachusetts) is grown organically in response to local market forces (Katz & Wagner, 2014).

Traditional urban revitalization projects often emphasized the commercial aspects of developments (i.e., housing, retail, sports stadiums). In contrast, UIDs focus on creating a dynamic physical realm that strengthens proximity and knowledge spillovers. UIDs as an urban strategy help the city’s effort to increase its global competitiveness by growing and attracting economic assets (both firms and talents) and by improving its branding (Katz & Wagner, 2014).

Barcelona’s Innovation District, 22@Barcelona, is credited to be the first innovation district that is officially branded by the city’s government. 22@Barcelona District of Innovation is a regeneration project that transformed 200 hectares of the city’s former inner-city industrial hub, only two kilometres away from the city centre. The city focused on the physical proximity of elements within the district, recognizing the nature of the innovation occurring through interaction and collaboration.

The city strategically developed the district, locating the firms and institutions in close physical proximity, increasing the proximity and engagement among the skilled knowledge workers. Along with the creation of new employment, the district features mixed-residential development (social housing, live-work spaces), research institutions and universities, open public spaces, and a rapid transportation system connecting the district to the rest of the city (Leon, 2008).

### ***URBAN INNOVATION DISTRICTS AS A BRANDING INITIATIVE***

The concept of UIDs is popularized because of its proven economic success. However, in many cases around the globe, the concept of UIDs only exists in the name as a branding initiative being used as a buzzword to rebrand inner-city neighbourhoods (Morrison, 2015). In this section, we attempt to understand the concept of place branding and how it is applied in UIDs.

In a world where cities and regions aggressively compete for investment in public and private sectors, brand reputation is critical. The brand is “both a lens through which information is viewed and a decision criterion” (Middleton, 2011, p. 15).

The concept of place branding involves multidisciplinary collaboration among marketing, place management, and urban development (Ryan & Mizerski, 2010). Branding of a place aims to promote itself as destinations to live and work, to visit, or to invest in through the projected images to the world (Kavaratzis, 2004; Zenker, 2011). It is not only an outward-looking activity but also a function of “boosting civic pride and generating social cohesion” (Harvey & Young, 2012, p.3).

Branding of a place is a collective action of place promotion, placemaking, image-



building, and the marketing of cities in the literature. Place promotion is defined as “the use of publicity and marketing to create selective images of specific localities targeted at specific populations” (Watkins & Herbert, 2003, p.252). Recently, city officials have been exploring the idea of branding places to establish the city as a brand to promote their cities to its existing and potential target groups (Braun & Zenker, 2010; Anholt, 2010). Place branding is a narrative design where the physical landscape is enhanced to communicate a set of images and stories (Stanton, 2006). Place branding can be a strategic government policy to better position the city economically, politically, and socially (Papadopoulos, 2004). Some of the variables that compose the image of a place and its branding are its nature, history, urbanity, diversity, and job availability (Stanton, 2006).

Place branding is a challenging exercise where the peculiar nature of the place is branded as marketable assets. Place branding is not only about designing the most appealing buildings and public spaces, but a conscious strategy to utilize design as a tool to tackle complex social, ecological, and cultural challenges (Van Alen Institute, n.d.; Papadopoulos, 2004). Spatial identity formed by place attributes such as culture, intellectual capital, and heritage adds value to a place brand. The well-positioned brand of a place is a vital asset in capitalizing on benefits such as attracting investment capital, talent, and companies (San Eugenio Vela, 2013). The expression of a place has formed three types of communication (see Table 2) (Kavaratzis, 2004).

Now considered as an integral part in the process of place development, the primary objective of place branding should not be driven by economic gain, but should aim to achieve a positive reputation for the city (Anholt, 2010). Further, the place branding strategy, should not be limited to projecting and communicating a certain image, but

should aim to promote pride and create a sense of belonging among residents (San Eugenio Vela, 2013).

**Table 2. Three types of communication in the expression of a place**

|                            |  |
|----------------------------|--|
| <b>Place Physics</b>       | <ul style="list-style-type: none"> <li>▪ Architecture</li> <li>▪ Real place offerings</li> <li>▪ Place's behaviour</li> </ul>                          |
| <b>Place Communication</b> | <ul style="list-style-type: none"> <li>▪ Formal communication through official channels (i.e. all forms of advertising or public relations)</li> </ul> |
| <b>Place word or mouth</b> | <ul style="list-style-type: none"> <li>▪ By the media and the residents</li> </ul>   |

*Based on Kavratzia (2004)*

Place branding is now a common tool in an economic development strategy, such as technology clusters (Nathan and Vandore, 2014). Such clusters have distinctive features that are particularly relevant to place branding. Branding of UIDs is greatly influenced by tech firms' styles of working; producing a distinctive atmosphere (Pratt 2002; Indergaard, 2004) and their talent pool whom explicitly prefer urban locality and lifestyles (Clark, Moonen, & Peek, 2017).

UIDs portray a distinct image of a place due to its unique characteristics of being a mash-up of entrepreneurs, research institutions, start-ups in a technologically wired mixed-use development connected by a public transit and bike-sharing program. Namely, UIDs embrace cityness - a term coined by Saskia Sassen (2008) referring to the urbanism attributes that were denigrated in the 20th century. These attributes are

complexity, density, diversity of people and cultures, and layering of the old and the new.

Place branding of such industry clusters have three main functions (Lundequist & Power, 2002): to set out a clear and coherent vision of the area or development in question; to use this to attract new activity; to complement that which existing individual firms are doing to promote and market themselves. Place branding of UIDs employs the strategic use of urban design elements to physically brand the district to create a clear, undeniable experience when people enter it. Branding elements of the UIDs include building massing, street design, public spaces, materials, and planting (Katz & Wagner, 2014).

### ***URBAN MORPHOLOGY OF URBAN INNOVATION DISTRICTS***

Smaller tech firms tend to cluster (Scott, 1997; Hall, 2000; Hutton, 2008) into cheaper neighbourhoods with a distinctive built form, converting warehouses into small office spaces (Pratt, 2000; Pratt, 2002; Indergaard, 2004; Hutton, 2008). The location enables them to exploit the economies of production and consumption that large cities offer (Zukin, 1982; Hall, 1998; Glaeser et al., 2001; Duranton & Puga, 2004). However, within the limited space of UIDs, land use is competitive for space with residential housing; in turn driving up rent and causing resident displacement (Hamnett and Whitelegg, 2007; Hutton, 2008).

UIDs promote a compact, accessible and diversified urban form offering mixed-use housing, office, and retail. The physical form of UIDs creates a sense of intimacy and coziness with easy walkability, encouraging face-to-face interaction. The frequent interaction of people in dense and highly networked spaces plays a crucial role in

innovation and the flows of ideas, creating the feel of an urban village (Storper & Venables, 2004; Wood & Dovey, 2015; Hutton, 2006).

The concept of UIDs is one of the most recent developments within an extensive collection of literature on the rise of the creative economy, creative classes, and the clustering of creative industries in urban areas. A broad set of literature in the field suggested that creative industries “do not locate randomly within cities and are sensitive to *characteristics of place*” (Wood & Dovey, 2015, p.52). Districts that are conceived as incubators of innovation (Peck, 2005), are often distinguished by their look and feel, character, and authenticity (Helbrecht, 2004; Hutton, 2006; Brown & Mczynski, 2009; Ho, 2009).

Wood and Dovey (2015) explored the commonly neglected subject of the urban morphology of urban creative clustering using case studies in the Australian context. Using mapping as the primary method, they uncovered that such clusters are characterized by a morphology “linked to a multiplicity of functions — production, exchange, reproduction, recreation — and socio-economic mix” (Wood & Dovey, 2015, p.52). Also, the interaction of people in dense, highly networked spaces and built forms produces a unique place characteristic described as a buzz or atmosphere (Wood & Dovey, 2015).

While the importance of quality of place in clustering is widely acknowledged, there is a lack of systematic analysis of the associated urban morphologies (Rantisi, Leslie, & Christopherson, 2006; Katz & Wagner, 2014; Wood & Dovey, 2015). The next section of this chapter identifies place characteristics of UIDs to examine how the urban morphology of UIDs influences the creation of a favourable environment for innovation.

## 2.4 CATCHING A PLACE CHARACTERISTICS OF URBAN INNOVATION DISTRICTS

One way to “catch a city” is through describing the identity of a place (regularly understood as the characteristics of a place). Such a description of a place is often formed through case studies (Zenker, 2011). By reviewing the literature, place characteristics of UIDs can be summarized as a highly connected and compact place that promotes a mixed-use neighbourhood (see Table 3).

**Table 3. Place characteristics of UIDs**

| Place characteristics | Key excerpts from literature  |
|-----------------------|---|
| Compactness           | <ul style="list-style-type: none"> <li>Innovation Districts (IDs) are a physically compact place in which people and knowledge-based resources, such as research institutions; business incubators and accelerators; start-ups; and leading-edge anchor companies, are concentrated (Katz &amp; Wagner, 2014).</li> </ul> |
| Mixed-use development | <ul style="list-style-type: none"> <li>With concentration of economic, social network, and physical assets, IDs promote mixed-use development, encourage sharing economy, and drive innovations (Stadshavens Rotterdam, 2015; Morisson, 2015; Katz &amp; Wagner, 2014; Talking-ton, 2014; Clark, 2010).</li> </ul>        |
| Connectivity          | <ul style="list-style-type: none"> <li>Supported by density, everyday amenities are located within walkable distance encouraging face-to-face encounters with other innovative people in the district (Wood &amp; Dovey, 2015).</li> </ul>  |

### **COMPACTNESS**

It is widely acknowledged that a rising number of innovative firms are choosing to congregate and co-locate in compact, amenity-rich enclaves in the core of cities

(Hutton, 2004; Bugliarello, 2004; Florida, 2014; Morisson, 2015). Urban compactness of UIDs centers around density which the most commonly used measure of compactness (Burton, 2002).

High densities are associated with urban vitality and creativity (Haughton & Hunter, 1994) and are credited with creating increasingly dynamic urban districts (Taylor & Nostrand, 2008). Density and networking are two of the notable effects at work in urban innovation districts; playing a crucial role in innovation and the flow of ideas (Wood & Dovey, 2015). It enables everyday amenities to be located within walkable distance. Frequent face-to-face interaction with other innovative people in the district encourages knowledge spillover (Storper & Venables, 2004). Storper and Venables (2004) states that face-to-face interaction is crucial in environments like UIDs where information “is imperfect, rapidly changing, and not easily codified, critical features of many creative activities” (p.351).

The density of UIDs does not only refer to the conventional urban density of population and built form, but to the concentration of resources; including human capital and economic and physical assets.

Proximity to urban cores enables exploitation of the production and consumption that cities offer (Zukin, 1982; Hall, 1998; Glaeser et al., 2001; Duranton & Puga, 2004). The downtown locale also increases a firm’s competitiveness for well-educated, young talent. Young talent plays a vital role in the formation and growth of start-ups, and therefore they play a crucial role in driving urban revitalization.

The talent pool for the tenants of UIDs — technology companies, start-ups, business incubators and accelerators — explicitly prefer urban locations and lifestyles (Clark, Moonen, & Peek, 2017). Cortright’s study (2014) showed that young, talented adults between the ages of 25 and 34 years old, with a Bachelor’s degree or a higher level of education, are generally living within close proximity to metropolitan areas; fueling the economic growth and urban revitalization. The number of well-educated young adults living in urban communities increased by 37 percent since 2000. This trend is apparent in Silicon Valley, where many firms are moving their offices to San Francisco to be closer to a large talent pool. Start-ups can grow faster in an urban setting as they have access to young workers, investment, and opportunities to network with other entrepreneurs (Cortright, 2014; White, 2016).

### ***MIXED-USE DEVELOPMENT***

UIDs promote mixed land uses (Stadshavens Rotterdam, 2015; Morisson, 2015; Katz & Wagner, 2014; Talkington, 2014; Clark, 2010). Diversified mixed-usage makes the urban form more permeable and denser, attracting people of varying income levels and creates a vibrant urban street life. Such an urban environment with a high level of social, functional, and formal diversity, attracts innovative industries to co-locate in districts (Wood & Dovey, 2015). Mixed land use can be encouraged by several factors, including historic adaptive re-use (Ho, 2009; Hutton, 2006; Jacobs, 1961), urban block size (Metrasys, 2012), and building sizes (Jacobs, 1961).

### **URBAN BLOCKS**

In the study of Alnwick, Conzen (1960) revealed that the most stable elements of the urban fabric were street and block patterns. Often developed over hundreds of

years, the street pattern defines an urban block and provides a public-space network between those blocks. Block configuration is an essential part of the urban fabric, shaping a coherent and unified urban form influencing the morphological dynamics of the city.

Moudon (1986) suggested that smaller lot sizes helped produce diverse, resilient urban environments. She believed that “by ensuring that property remains in many hands, small lots bring important results, many people make many decisions, thereby ensuring variety in the resulting environment” (p. 188).

Mixed-use neighbourhoods should contain a range of block sizes to promote spatial diversity (Metrasys, 2012). The mixture of block sizes allows for more permeable street layouts and encourages a variety of land uses. Small-block street systems are referred to as fine-grained. Fine-grained street systems offer more choice in circulation patterns and are correlated with higher land values, as it increases the creation of corner lots (Bohannon, 2004).

### BUILDING SIZES

Jacobs (1961) believed that the architectural mix embodies diverse expressions of identity. Diverse building types and sizes allow for various rental values, which allows for a mix of different activities with different people.

### HISTORIC ADAPTIVE RE-USE

Innovative production has a certain synergy with post-industrial building types (Hutton, 2006; Ho, 2009; Jacobs, 1961). Industrial buildings’ flexibility poses the advantage of being re-purposed to suit innovation firms of varying sizes; from open



studio to smaller workspaces and extended office and interaction spaces like a cafes Jacobs (1961) valued the idea of the retention of old buildings as she believed that an architectural mix promotes diversity.

## **CONNECTIVITY**

### WALKABILITY

In UIDs, supported by density, everyday amenities are located within a walkable distance; encouraging face-to-face encounters with other innovative persons in the district (Wood & Dovey, 2015). UIDs feature spaces that are an extension of the office base (Martins, 2015), enabling work to be physically dispersed, but promoting intensive face-to-face interaction for complex, productive activities (Storper & Venables, 2004). These spaces also satisfy the prevalence of small firms and freelancers, placing a premium on networking with like-minded people (Martins, 2015). There are often landmark buildings or public spaces that anchor the district, reinforcing cluster identity (Hutton, 2006; 2008).

The network effect refers to the added value due to interactivity between nodes within a network (Katz & Shapiro, 1985; Liebowitz & Margolis, 1994). UIDs are a place where relations of trust can develop through frequent physical interactions on local streets. Thus, this face-to-face network creates a socialized environment where it is safer to take risks (Rantisi, Leslie, & Christopherson, 2006). The physical form of such districts creates a sense of intimacy and coziness; with easy walkability within pedestrian-friendly streetscapes creating the feel of an *urban village* (Hutton, 2006).

## PERMEABILITY

A high-level of permeability in UIDs creates a sense of intimacy and coziness where it is safer to walk and interact with strangers (Hutton, 2006; Rantisi, Leslie, & Chirstopherson, 2006). Permeability indicates the ease of movement and the potential to interact in urban space. Along with density (compact form), permeability plays a critical role in promoting an intensive face-to-face urban interaction. Such urban interaction encourages the flow of ideas, playing a crucial role in innovation (Storper & Venables, 2004; Jacobs 1961).

Permeability is a measure of the opportunity for movement in an environment; allowing people the choice of multiple routes through and within it. The ability to see the routes through an environment is referred to as a visual permeability, while the ability to move through an environment is referred to as a physical permeability. It is important to note that an environment can be visually permeable but not physically permeable and vice-a-versa. Typically, an area with smaller blocks is more permeable as they offer a greater choice of routes. Smaller blocks also tend to increase visual permeability, improving people's awareness of the available choices (Carmona, Heath, Oc, & Tiesdell, 2010).

## 2.5 STUDY'S CONTRIBUTION

Urban morphology analysis of UIDs in the Canadian context investigates how the physical form of a place can affect the characteristics of a place. This study hoped to contribute in forming a better understanding of the concept of urban morphology, and how it can be applied to urban design and planning practice (Hall, 1997, 2008;

Biddulph and Punter, 1999; Carmona, 1999, 2001; Parolek et al., 2008; Punter and Carmona, 1997; Larkham, 2005; Walters, 2007; Samuels, 2008; Marshall, 2011).

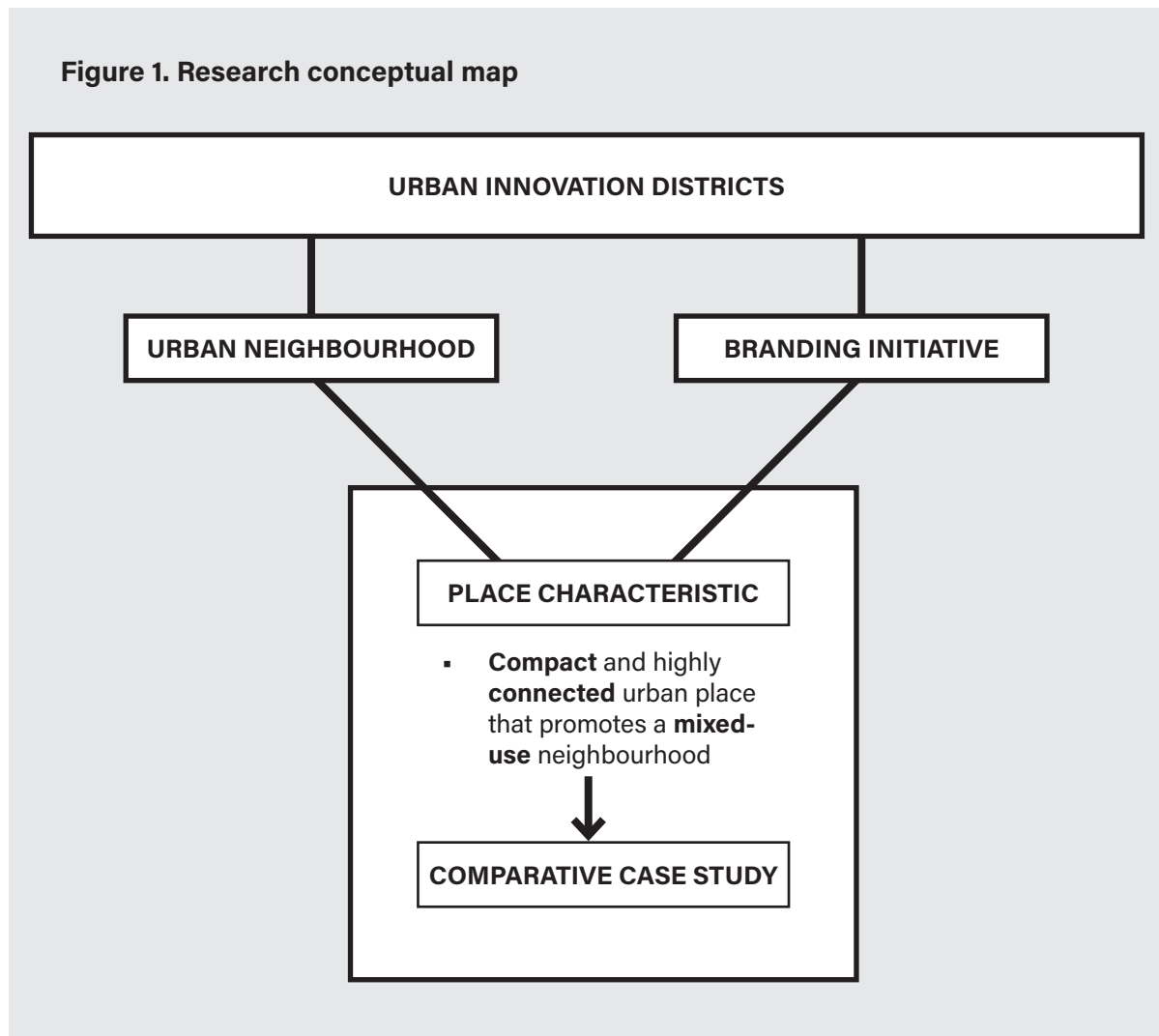
To date, the academic research on UIDs has been focused on their affect on job creation and economic development (Glaeser, 2009), and on popularizing the concept to rebrand inner-city neighbourhoods (Morisson, 2015). Along with Katz and Wagner (2014), the author argued that there is a need for more diversified perspectives on the matter. This study has taken an explanatory approach to examine the urban morphology of UIDs. This research challenged that UIDs are not only a branding initiative, but a solid urban strategy that can create synergy between economic, physical, and network assets of the city.

This study hoped to forge better theoretical and conceptual links on how urban morphology could be incorporated into the placemaking process by focusing on exploring how morphological elements of UIDs affect place characteristics.

## 2.6 PROPOSED CONCEPTUAL MAP & THEORETICAL FRAMEWORK

The conceptual and theoretical framework underlying this study was based on morphological and place characteristics of UIDs. The framework was developed further according to the research methodology by considering the urban morphology of UIDs (see Figure 1). The theoretical framework aimed to contribute to form a better understanding of the way morphological elements affect the characteristics of a

place. The place characteristics that were identified from the review of literature are compactness, mixed-use development, and connectivity.



This study distilled place characteristics of UIDs according to place brand elements from the categories suggested by Grabow et al. (1995), Anholt's (2006), and Zenker (2011). Grabow et al. (1995); these four 'picture' categories were: the business picture, the cultural picture, the historical picture, and the spatial picture. The spatial picture refers to the physical and geographic structure of a place, which is congruous with the previous discussion of urban blocks and buildings of UIDs. Anholt (2006) developed

the City Brand Hexagon: the presence, the place, the potential, the pulse, the people, and the prerequisites. The conversation of UID's compactness evolved around the social and economic advantages, and the potential of their location. Connectivity of UIDs aligns with the place brand element of pulse, as walkability and permeability are known to promote vibrancy and an urban lifestyle. Lastly, all three scholars believe the place history should be one of the categories of the place brand element as it evokes place quality and culture (referred to as the prerequisites by Anholt (2006) and as the historical picture by Grabow et al. (1995)).

The framework was established based on Kat and Wagner's (2014) research on UIDs in the North American context. Acknowledged by many scholars (for example, Morrisson, 2015; Katz & Wagner, 2014; Talkington, 2014; Clark, 2010), UIDs are a compact and connected urban neighbourhood with a concentration of economic, social networking, and physical assets promoting mixed-use development. Further, under each theme, several variables were chosen to analyze the urban morphology of UIDs in Canada (see Table 4).

**Table 4. Theoretical framework**

| Place characteristics    | Compactness  | Mixed-use development  | Connectivity   |
|--------------------------|--|--|--|
| Type of assets           | <ul style="list-style-type: none"> <li>▪ Economic</li> <li>▪ Physical</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Physical</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Network</li> </ul>  |
| Place brand element      | <ul style="list-style-type: none"> <li>▪ the Potential (Anholt, 2006)</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Spatial picture (Grabow et al., 1995)</li> <li>▪ Place history (Zenker, 2011)</li> </ul>                                    | <ul style="list-style-type: none"> <li>▪ The Pulse (Anholt, 2006)</li> </ul>   |
| Quantitative Measures    | Density <ul style="list-style-type: none"> <li>▪ Gross density (population density)</li> <li>▪ Net density (built-up density)</li> <li>▪ Concentration of resources</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Diversity in urban block size</li> <li>▪ Diversity in building size</li> <li>▪ Level of historic adaptive re-use</li> </ul> | <ul style="list-style-type: none"> <li>▪ Walkability</li> <li>▪ Permeability</li> </ul>  |
| Qualitative Measures     | <ul style="list-style-type: none"> <li>▪ Case study images</li> <li>▪ Figure ground map of developed area</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Street and block configuration</li> <li>▪ Placement of buildings in a lot</li> <li>▪ Land use policy</li> </ul>             |  |
| Place image implications | <ul style="list-style-type: none"> <li>▪ Urban vitality and creativity (Haughton &amp; Hunter, 1994)</li> <li>▪ Dynamic urban districts (Taylor &amp; Nostrand, 2008)</li> </ul> | <ul style="list-style-type: none"> <li>▪ Social diversity (Jacobs, 1961)</li> <li>▪ <i>Buzz or atmosphere</i> (Wood &amp; Dovey, 2015).</li> </ul>                   | <ul style="list-style-type: none"> <li>▪ Sense of intimacy and coziness (Storper &amp; Venables, 2004; Wood &amp; Dovey, 2015)</li> <li>▪ Feel of an urban village (Hutton, 2006)</li> </ul> |

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

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#### **3.1 INTRODUCTION**

This chapter details the research design process, the methodology of data collection and data analysis based on the conceptual and theoretical framework. It also discusses the process and rationale that was used for selecting case studies to answer the main research question:

*What are the place characteristics that distinguish UIDs, and how does urban morphology influence the formation of such characteristics?*

An answer to the main research question was given through qualitative and quantitative empirical research by adopting both a structured and an unstructured approach (Kumar, 2011). A mixed-methods strategy allowed both methods to complement each other by filling in the gaps, and further promoting mutual understanding with relevant links (Johnson, Onwuegbuize, & Turner, 2007). More specifically, it undertook the mixed transformative methods to examine the place characteristics of UIDs in the Canadian context through the lens of urban morphology. In this form of mixed-method design, the researcher converged both quantitative and qualitative data to provide a comprehensive analysis of the research problem (Creswell, 2014).

This research employed empirical evidence to describe the morphological features of

UIDs (Golicnik, 2010). This study extracted morphological data from case studies and employed a series of secondary data analysis and GIS analysis using visual support with figure-ground mapping.

This study adopted a multiple-case study design to identify the place characteristics of UIDs and to explore how morphological elements influence the formation of such characteristics. The research analyzed and compared UIDs across Canada. The author believed that urban morphology is a field that has significant potential in its application to urban planning. The objectives of this study were to explore the urban morphology of UIDs in Canada, and to explore the potential of integrating urban morphology to help inform better planning and place-making practices.

## 3.2 CASE STUDIES

### ***CASE STUDIES SELECTION PROCESS***

An investigation of urban morphology of UIDs was explored through a multiple-case study design. Five case studies in the Canadian context were selected for the study sites (see Figure 2).

This study examined UIDs in Canada, specifically; Gastown, Exchange District, Innovation District, Discovery District, and Cité du Multimédia. Case studies were chosen based on their location and using the criteria extracted from Katz and Wagner's (2014) definition and categorization of IDs . Selected case studies were located in physically-compact urban environments and were home to anchor institutions, business incubators, and start-ups (see Table 5). Other important aspects



of selecting case studies were, the significant presence of economic assets within a defined district boundary, and official designation of the district by the municipal government.

**Figure 2. Location of selected case studies**



There were similar districts within Canada that meet one of the selection criteria. For instance, Halifax Innovation District fulfilled the urban location criteria, but did not meet the physically compact and the defined boundary components. Suburban Innovation Districts, such as in Guelph and Hamilton, did not meet the intention of this study of examining the morphological elements of urban environments.

**Table 5. Selected UIDs in Canada**

|                        | <b>Gastown</b>                                   | <b>Exchange District</b>  | <b>Innovation District</b>                            | <b>Discovery District</b>  | <b>Cité du Multimédia</b> |
|------------------------|--|---|---|--|---------------------------|
| <b>Geography</b>       | Vancouver, BC                                    | Winnipeg, MB  | Kitchener, ON   | Toronto, ON  | Montréal, QC              |
| <b>Key industry(s)</b> | social innovation, creative, start-up businesses | art, design, technology, social innovation, start-up businesses | information technology, software, start-up businesses | hospitals, research institutions, biotechnology, start-up businesses | information technology    |

As a result, the selected case studies - although located in a different context and geographical location - shared a common identity as UIDs. The case studies also featured a range of urban configuration with various building arrangements and street patterns. Therefore, each case study provided an opportunity to explore a variety of urban forms that share similar place characteristics.

**A. Gastown** (Vancouver, BC)

Gastown is not only a retail and commercial district, but is one of the key districts in Vancouver’s innovation economy. The area is designated as one of the eight innovation clusters by the City of Vancouver. The district is home to many social innovators , creative, and start-up businesses (City of Vancouver, n.d.). As it was designated as a National Historic Site, “Gastown offers a diverse mix of retail and dining options housed within authentic heritage architecture, alongside a vibrant

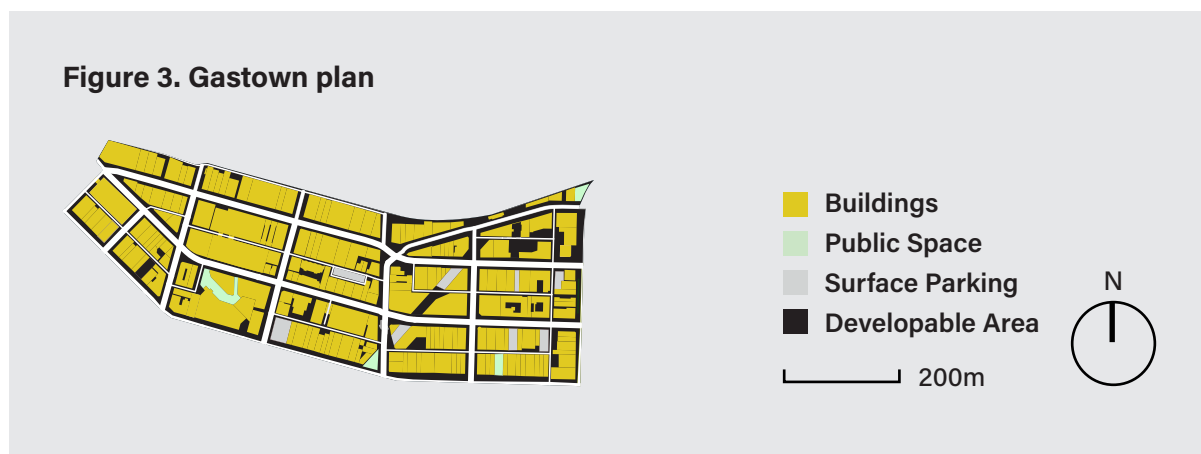
creative and tech scene” (Bizmap, n.d., Economic Data page).



Image 1. Aerial view of Gastown. Gastown, Vancouver, Canada, by Aditya Chinchure, 2018, <https://unsplash.com/photos/DrizqCuAV2o>



Image 2. Ground view of Gastown. Gastown, Vancouver, Canada, by Elora Manzo, 2017, <https://unsplash.com/photos/SZb5n7G2JhM>



Gastown is one of the most densely populated areas in Canada. According to Statistics Canada’s 2016 census, there were approximately 108,128 residents and 501 businesses operating within the district, size of 0.17 km<sup>2</sup> (Bizmap, n.d.). Of 501 businesses, 124 businesses in Gastown were defined as innovation drivers and innovation cultivators.

### **B. Exchange District (Winnipeg, MB)**

Nicknamed the “Chicago of the North”, Exchange District features more than one hundred turn-of-the-century heritage buildings within 20-square-blocks. A

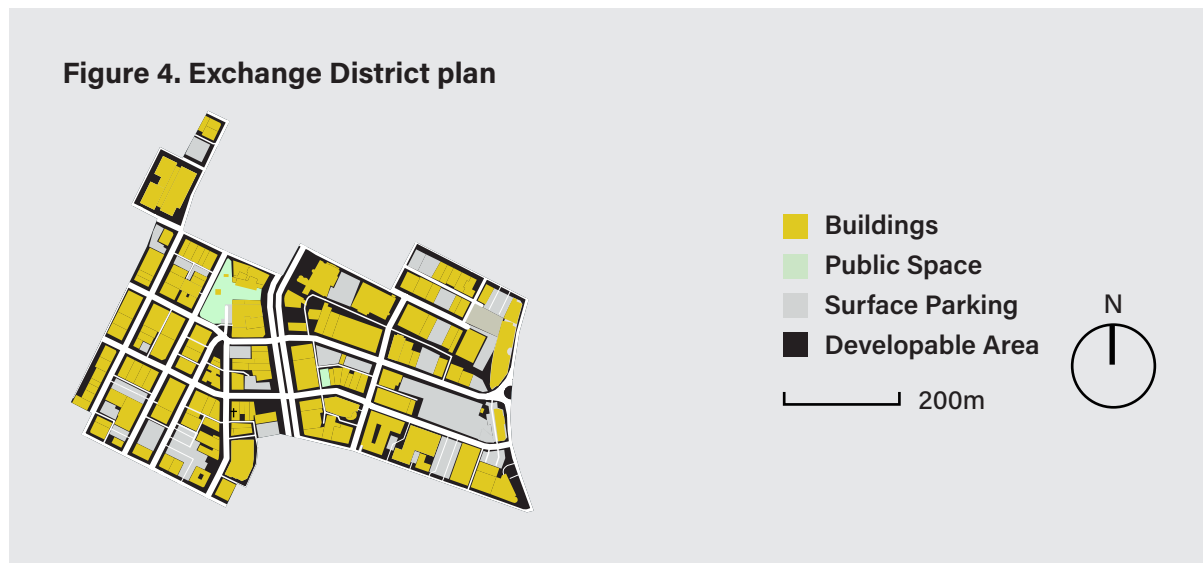
designated National Historic Site, the Exchange District is a vibrant place to work, live, play and celebrate Winnipeg's architectural heritage (Tourism Winnipeg, n.d.).



Image 3. Aerial view of Exchange District. Exchange District, Winnipeg, Canada, by Adrian Cheung, 2016, <https://globalnews.ca/news/2499611/first-fridays-kicks-off-in-winnipeg-exchange-district-february-5/>



Image 4. Ground view of Exchange District. Exchange District, Winnipeg, Canada, by Travel Manitoba, 2016, <https://www.travelmanitoba.com/blog/post/built-it-and-they-will-come/>



Exchange District is renowned to be a cultural and creative centre of the prairies, but for the last 5 years it is seeing significant growth in its tech industry. Exchange District is now home to many technologies, social innovation, start-up businesses Exchange District's high concentration of economic assets make it a favourable environment for innovation to occur. The District is home to 197 innovation drivers

and innovation cultivators. The district is growing in popularity with tech tenants, with headquarters of SkipTheDishe,s and Red River College’s brand-new Innovation Centre. Recently, the world-renowned software company Ubisoft opened its studio creating over a hundred jobs over the next five years (The Canadian Press, 2018).

### **C. Innovation District (Kitchener, ON)**

Kitchener’s Innovation District serves as Waterloo Region’s centre of creativity, innovation, and entrepreneurship (City of Kitchener, 2014; Downtown Kitchener, n.d.). The district is anchored by Google’s Canadian headquarters, Velocity and Communitech— one of Canada’s most productive startup incubators. With a strong presence of innovation cultivators supporting the growth and ideas of individuals and small firms, the Innovation District is home to over 200 start-ups creating a vibrant innovation scene.



Image 5. Aerial view of the Innovation District. Innovation District, Kitchener, Canada, by City of Kitchener, 2012, [https://www.downtownkitchener.ca/en/resourcesGeneral/Downtown\\_Kitchener\\_Action\\_Plan\\_2012-2016.pdf](https://www.downtownkitchener.ca/en/resourcesGeneral/Downtown_Kitchener_Action_Plan_2012-2016.pdf)

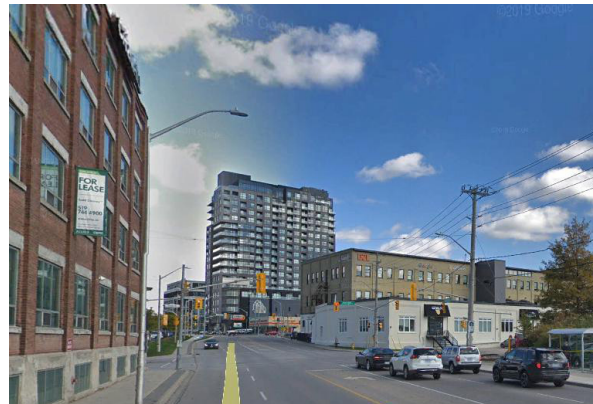
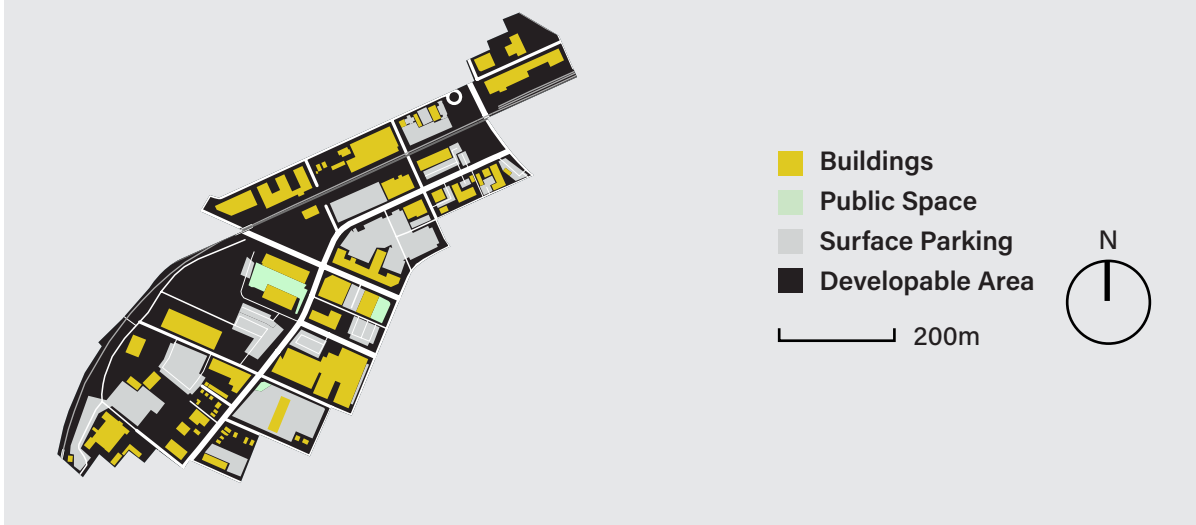


Image 6. Ground view of the Innovation District. Innovation District, Kitchener, Canada, by Google Earth, 2018.

Innovation District is officially designated by the City’s Official Plan, identified as one of the Urban Growth Centres. The City of Kitchener recently launched a brand strategy called *Make it Kitchener* which aimed to develop the Innovation District

**Figure 5. The Innovation District plan**



as the heart of the system (City of Kitchener, 2016), supporting a start-up and entrepreneurial culture, and supporting businesses that are looking to expand.

#### **D. The Discovery District** (Toronto, ON)

The Discovery District in Toronto is comprised of hospitals and research institutions. The cluster specializes in biotechnology and start-up businesses. The anchor tenant of the district is MaRS, who claimed themselves as a leader in the trend toward UIDs. As the largest urban innovation hub in North America, MaRS occupies 1.5 million square feet in downtown Toronto. It houses a diverse community of more than 120 tenants, including research labs and global tech companies (MaRS, n.d.).

Under the Toronto Official Plan, Discovery District is designated as an institutional area. The Plan recognized that the clustering and interaction among universities, hospitals, and research facilities plays a critical role in innovation. Thus, the Plan encourages innovation drivers and innovation cultivators to congregate and to engage in joint ventures to create new products and services (Toronto, 2019).



Image 7. Aerial view of the Discovery District. The Discovery District, Toronto, Canada, by the University of Toronto, 2019, <https://medicine.utoronto.ca/about-faculty-medicine/vice-provost-relations-health-care-institutions>



Image 8. Ground view of the Discovery District. The Discovery District, Toronto, Canada, by MafaldaBoy, 2014, <https://urbantoronto.ca/news/2014/02/mars-center-phase-ii-looking-great-college-and-university>

**Figure 6. The Discovery District plan**



Kitchener’s Innovation District and Toronto’s Discovery District are two major hubs within Canada’s technology supercluster, the Toronto-Waterloo Innovation Corridor. The Toronto-Waterloo Innovation Corridor employs over 200,000 workers in the tech sector, second only to Silicon Valley in North America (McKinsey & Company, 2016).

### E. Cité du Multimédia (Montréal, QC)

The development of Cité du Multimédia follows the “re-imagined urban area” model - a physical and economic transformation of the historic waterfront (Katz & Wagner, 2014). The district was a government-led, urban-renewal project in the late 1990s in Montréal; redeveloping the abandoned nineteenth-century industrial area of the city into a business cluster for information tech companies. High-tech companies in the district employ approximately 6,000 workers (Tremblay & Rousseau, 2005).

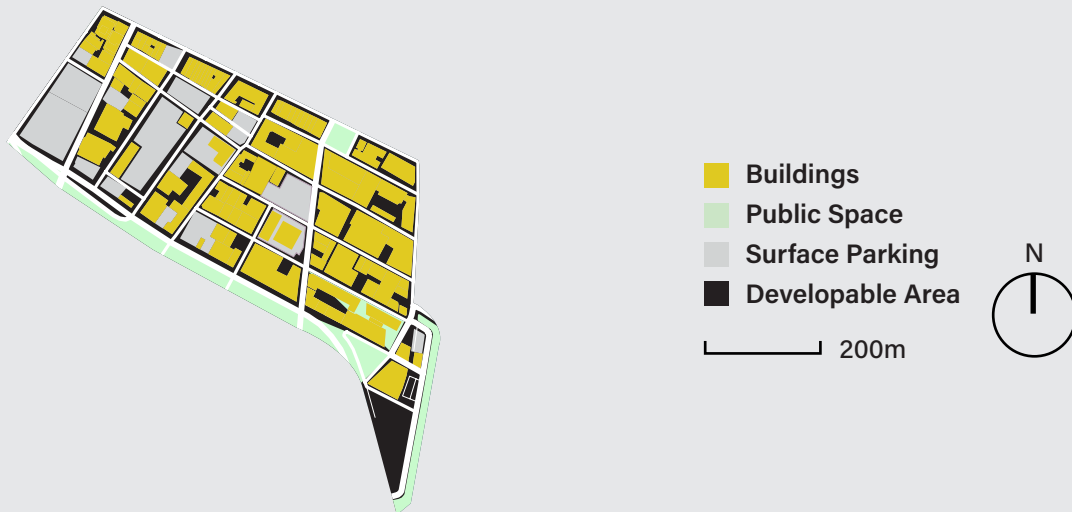


Image 9. Aerial view of the Cité du Multimédia. La Cité du Multimédia, Montréal, Canada, by Alexis Hamel, 2008, <https://imtl.org/image.php?id=5082>



Image 10. Ground view of the Cité du Multimédia. La Cité du Multimédia, Montréal, Canada, by Priscilla Ananian, 2016, <https://www.actualites.uqam.ca/2016/role-urbanisme-fabrique-lieux-innovation>

Figure 7. Cité du Multimédia plan





### ***RATIONALE FOR ADOPTING A MULTIPLE CASE STUDY METHOD***

The explanatory nature of the research question imposed on this study – “how” and “why” questions - lead to a case-study-based research method (Yin, 2003). Case studies allow for the exploration of theories. They provide opportunities for theory application to examine and compare in multiple contexts. The investigation of the urban morphology of the UIDs was framed upon an explanatory, sequential case study. Using this type of research design, five UIDs in the Canadian context were explored through morphological elements guided by the variables extracted from the literature review. Case studies are used as explanatory tools to describe and explain how place characteristics of UIDs — compactness, mixed-use development, and connectivity — are influenced by the morphological elements of an urban form.

According to Yin (2003), case studies are used out of the desire to understand complex social phenomena. The case study approach is a “strategy of inquiry in which the research investigates in depth a program, event, activity, process of one or more individuals” (Creswell, 2003, p. 13). It is a comprehensive research strategy that covers the logic of design, data collection techniques, and specific approaches to data analysis (Stoecker, 1991; Yin, 2003). The case study approach is particularly useful in cases where the boundaries between phenomena and context are not clear (Patton, 2002). The nature of the case study approach leads to the employment of a mixed-use research method. Mixed-used research allows for a better understanding of the research problem, drawing both quantitative and qualitative assumptions (Creswell, 2014).

This study has adopted a multiple-case study design. The multiple-case study design is often more compelling and robust (Herriott & Firestone, 1983). Multiple-case

studies are suitable for such an empirical study. Compared to a single-case study, having two or more cases can produce a stronger argument; reducing the fear of the uniqueness or an artifactual condition surrounding a particular case (Yin, 2003). Thus, multiple- case study design was suitable to identify the place characteristics of UIDs in Canada, and to explore how urban morphology influences the formation of such characteristics.

UIDs are being implemented across multiple contexts around the world as a new urban strategy. This study has taken the opportunity to investigate a trendy urban phenomenon - in the Canadian context - through the lens of urban morphology. By employing a multiple-case study design, this study hoped to address the knowledge gap – a result of a lack of research - in the Canadian context.

The use of case studies remains to be one of the most challenging endeavours in social science research (Yin, 2003). This study used a multiple-case study in an explanatory manner to attempt to design a good case study; to collect, present, and analyze data and to explore the urban morphology of UIDs in Canada. The explanatory case study approach was used to explore new areas and issues where little theory is available, or measurement is unclear (Yin, 2013).

### 3.3 RESEARCH APPROACH

There are different methods for studying urban form. Since the systematic analysis of UIDs was absent (Katz & Wagner, 2014), this study suggested a collaborative research approach between the morphological method known as the British school and the scientific approach. British school of thought analyzes the morphological aspect of the built environment by employing a descriptive, analytical, and explanatory approach (Moudon, 1997; Silva, 2015). Widely used in the fields of architecture, urban design and planning, the scientific approach investigates urban form empirically and quantitatively attempting to analyze the relationship between different measures (Pakzad & Salari, 2018; Kim, 2012). In terms of perspective on urban form, this study has taken an urban design perspective. An urban design perspective is based on comparing case studies to examine what kind of urban form would be considered as a good urban form (Pakzad & Salari, 2018).

This paper has descriptive and explanative research based on principles of urban morphology. More specifically, the explanatory sequential mixed method was used. The research sequentially examined UIDs' place characteristics of compactness, mixed-use development, and connectivity. Through this journey, the findings and analysis of each characteristic built on one another.

This study was undertaken with the collection and use of secondary sources of data. Here, secondary sources refer to types of data that are collected by someone else. The researcher can extract the required information for the study with proper acknowledgment of sources. It is crucial to make sure that collected secondary source data are from valid and reliable sources (Kumar, 2011). The primary source of

secondary data was Statistics Canada, a Canadian government agency commissioned to produce statistics regarding population, resources, economy, society, and culture (Statistics Canada, n.d.), GIS analysis, Walk Score, government documents, and heritage databases for each municipality. Findings through quantitative methods were supported by a qualitative method of figure-ground mapping.

### **RESEARCH PHILOSOPHY/PARADIGM**

While planning a study, researchers need to consider the philosophical worldview assumptions that they bring to the study, the research design that is related to the chosen worldview, and the research methods that translate the approach into practice (Creswell, 2014). The term “worldview” refers to a basic set of beliefs that guide a person’s actions (Guba, 1990, p. 17). Also, commonly known as the research paradigm, it is a conceptual framework guide used by researchers to examine problems and to find solutions with corresponding methodological approaches and tools (Kuhn, 1962; Kawulich, 2012). This information helps researchers to justify their choice of research methods - qualitative, quantitative, or mixed-methods approach (Creswell, 2014).

This research was to be guided through the lens of the pragmatic philosophical worldview. Pragmatism is not committed to any one system of philosophy and reality, and it emphasizes the research problem and solutions to problems (Patton, 1990; Creswell, 2014). Pragmatist researchers apply mixed methods to their research. This allows the freedom of choosing the best methods, techniques, and procedures of research to provide the best understanding of a research problem; drawing both quantitative and qualitative assumptions liberally (Creswell, 2014). This allows the

opportunity to collect information and make an inquiry into complex problems, both objectively and subjectively (Saunders, Lewis, & Thornhill, 2009).

The pragmatic view's recognition that a single point of view cannot give the entire picture and an acceptance of multiple realities, fit the purpose of this study (Saunders et al., 2009). This study dissected UIDs from the perspective of urban morphology. This study recognized that the findings of case studies may reveal multiple realities of the impact of a particular morphological element (i.e. the size of urban block and its impact on walkability).

The philosophical worldview influences and shapes the approach to research (Creswell, 2014). However, it was crucial to understand that looking at a problem with a limited perspective is not ideal as the imposed research question for this study required the combination of different methods to answering it (Saunders et al., 2009; Tashakkori and Teddlie, 2003; Creswell and Plano Clark, 2011).

### ***MEASURING VARIABLES***

From the literature review, a set of place characteristics of UIDs was identified and related indicators were derived (see Table 6). The description and research methodology for each indicator was expanded further and is discussed in the next part of the chapter.

**Table 6. Measuring variables**

| Place characteristics        | Description  | Indicators   |
|------------------------------|--|--|
| <b>Compactness</b>           | The quality of being closely packed together in a small space – often characterized by high-density, mixed-use, and reuse of brownfield land (Burton, 2002).   | <b>Density</b><br>a. Gross density (population density)<br>b. Net density (density of built form)<br>c. Concentration of resources   |
| <b>Mixed-use development</b> | Diversified urban form providing essential services to residents and works in the district (i.e. housing, office, and retail). Mixed-use development activates streets and the public inviting a mix of people to shop, browse, and mingle reflecting contemporary urban consumption patterns of the new economy (Hutton, 2010). | <b>Urban block</b><br>a. Street and block configuration<br>b. Diversity in size<br><br><b>Buildings</b><br>a. Placement within a block<br>b. Diversity in size<br><br><b>Historic Adaptive reuse</b><br><br><b>Land use policy</b> |
| <b>Connectivity</b>          | Cities’ and citizens’ network organization, connectedness, and circulation. It is defined as the available alternative ways between spaces or buildings (Handy et al, 2002: 66).   | <b>Walkability</b><br><br><b>Permeability</b>  |

## 3.4 RESEARCH METHODS

This research measured and analyzed the urban morphology of UIDs in Canada. Through the literature review, it was found that UIDs share common traits of being high density, mixed-use, containing efficient public transport and dimensions that encourage walking and cycling (Burton, 2002). Firstly, the urban compactness of UIDs was evaluated using three types of density – gross, net, and concentration of resources - as the predominant urban variables. Evaluating mixed-use development takes a morphological perspective investigating the factors that are known to promote mixed-land use, such as a variety of urban blocks, building sizes, and historic adaptive reuse within the district. Finally, the connectivity of UIDs was evaluated in terms of walkability and permeability. The table below defines each indicator and identifies previous studies that this study references for its measuring methods (see Table 7).

### **COMPACTNESS**

Density is one of the common indicators used when measuring the compactness of urban form in studies (for example, Kotharkar et al., 2014; Burton, 2002; Coorey & Lau, 2005). Density can be measured and expressed in a variety of ways. Typically, density is expressed in relation to a single unit of land area — for example, population per square kilometre.

High-density is the most common interpretation of urban compactness. Density can be measured as the density of a population (gross density) and density of built forms (net density) (Burton, 2000). In discussing UIDs, density also refers to the

**Table 7. Description and relevant studies for selected indicators**

| Indicators  | Description   | Relevant studies  |
|---|---|---|
| <p><b>Density</b></p> <ul style="list-style-type: none"> <li>a. Gross density (population density)</li> <li>b. Net density (density of built form)</li> <li>c. Concentration of resources</li> </ul>  | <ul style="list-style-type: none"> <li>a. density of built form within a given spatial unit</li> <li>b. number of people within a given spatial unit</li> <li>c. the concentration of re-sources, including human capital and economic and physical assets</li> </ul>   | <ul style="list-style-type: none"> <li>a &amp; b. Kotharkar et al. (2014), Burton (2002), &amp; Coorey and Lau (2005)</li> <li>c. Brown et al. (2004), Katz &amp; Wagner (2014) &amp; Cortright (2014)</li> </ul> |
| <p><b>Urban block</b></p> <ul style="list-style-type: none"> <li>a. Street and block configuration</li> <li>b. Diversity in size</li> </ul> <p><b>Buildings</b></p> <ul style="list-style-type: none"> <li>a. Placement within a block</li> <li>b. Diversity in size</li> </ul> <p><b>Historic Adaptive reuse</b></p> <p><b>Land Use Policy</b></p> | <ul style="list-style-type: none"> <li>a. the fundamental element of the physical structure of urban areas (Siksna, 1997) surrounded by streets and usually containing buildings (Kouwenberg, 2013).</li> <li>b. one of the least resilient morphological elements. Apart from major buildings, buildings only tend to survive if able to adapt to new land uses (Conzen, 1960).</li> <li>c. process of adapting buildings for new uses while retaining their historic features. Revitalizing the historic built fabric link the community to with the past and become a part of a cultural heritage (Zaitzevsky &amp; Bunnell, 1970).</li> <li>d. regulates and manages the development of land</li> </ul> | <ul style="list-style-type: none"> <li>a. Siksna (1997) &amp; Pakzad &amp; Salari (2018)</li> <li>b. Jacobs (1961)</li> <li>c. Jacobs (1961), Hutton (2006), &amp; Ho (2009)</li> <li>d. Yin (2013)</li> </ul>    |
| <p><b>Walkability</b></p> <p><b>Permeability</b></p>  | <ul style="list-style-type: none"> <li>a. a key urban design concept for street life intensities and transit-oriented urbanism (Cervero and Kockelman 1997; Krizek 2003; Lo 2009).</li> <li>b. an important place quality related to the street and block pattern which allows people a choice of ways through and within the built environment (Carmona, 2010).</li> </ul>   | <ul style="list-style-type: none"> <li>a. Brown et al. (2014)</li> <li>b. Pafka &amp; Dovey (2014)</li> </ul>   |



concentration of resources, including human capital, and economic and physical assets. Higher densities are perceived to be an essential component for achieving sustainability and a good urban design that promotes urban vitality and creativity (Haugton & Hunter, 1994; Calthorpe, 1993; Duany & Plater-Zyberk, 1991).

#### GROSS DENSITY (POPULATION DENSITY)

Population density refers to the number of people within a given spatial unit. Higher residential density is critical for urban vitality, increasing the range of opportunities that can be accessed within walking distance resulting in reduced car-travel (Burton, 2002). People living in closer proximity are likely to interact more socially – giving life to the place (Cadman & Payne, 1989).

Statistics Canada provides a detailed census profile for a dissemination block (DB). The DB is the smallest geographic area for which population and dwelling counts are disseminated. DB was selected to extract the census profile of the case study areas, referencing the boundary of each district (StatsCan, n.d.). In some cases where the DB did not line up precisely with the district boundaries, the DB that most closely matched the boundaries of the district was used.

Despite being the most commonly used measure in urban research and the measure that is easiest to obtain, gross densities can be misleading. In particular, for this study, gross density could be misleading in two ways. Firstly, gross density reveals very little about the density of the city's built-up area. Secondly, it could be misleading in cases where the boundary of the district does not coincide with the boundary of the urban area. Therefore, it was crucial to include the indicator of the density of the built-up area.

### NET DENSITY (DENSITY OF BUILT FORM)

The density of built form (also referred to as the net density) measures how built-up an area is. In land-use planning, higher densities of development are linked with lower energy consumption and the promotion of affordable housing (DoE, 1994; DETR, 1998). Net density complements gross density in the study of an urban form with dense development within large areas of open space, since it may appear to be low density based on gross measures (Burton, 2002).

The gross area refers to the total area within the district boundary. The boundary of each innovation district was identified by consulting Google Earth and online municipal documents such as Business Improvement Areas (BIAs), land use plan and zoning by-laws. Once the boundary of innovation districts was identified, the area was measured by using Google Map's polygon tool. Open land includes any land around buildings, including roads, surface parking, and parks. However, for the purpose of this study, the public plaza or park area was excluded from the open land since they are one of the physical assets of the UIDs (Katz & Wagner, 2014).

Using QGIS software, building footprints and public plazas or park areas of each district were traced off and calculated for their net area in km<sup>2</sup>. The net density was obtained by dividing the total number of people (from the 2016 Census) by the net area. The net density could be obtained by the following formula (Burton, 2002):

$$\text{Total number of people}/(\text{Gross area} - \text{Open land})$$

## CONCENTRATION OF RESOURCES

### *PROXIMITY TO CBD*

There have been several observations that the geography of innovation is shifting towards high-density, inner-city neighbourhoods near downtown (Hutton, 2004; Florida, 2014; Bugliarello, 2004; Morisson, 2005). This validates Florida's (2014) observation of the trend that high tech-related companies and start-up activities are shifting towards mixed-use, transit-oriented, and walkable urban centres. This study measured the concentration of resources in UIDs in Canada in terms of their proximity to the Central Business District (CBD) – also referred to as a financial district – of respective cities. Proximity to the CBD is a valid measure that indicates the concentration of resources. A CBD is widely recognized as being characterized by amenity-rich mixed-use neighbourhoods - residential, retail, commercial, universities, entertainment, government, financial institutions, medical centers, and cultural centres - with high connectivity (Rosenberg, 2018; Ewing & Cervero., 2010; Turrell et al., 2013; Yamada et al., 2012).

### *ECONOMIC ASSETS*

Katz and Wagner (2014) defined the economic assets of UIDs as the firms, institutions, and organizations that drive and support an innovation-rich environment. This study gathered information on the economic assets of each UID in Canada. The number of start-ups, relative businesses, institutions and organizations were counted to evaluate the density of economic assets per km<sup>2</sup>. Businesses that were counted towards economic assets were defined as Innovation drivers and Innovation cultivators by Katz and Wagner (2014).

Innovation drivers are the research and medical institutions, firms, and start-

ups that are focused on developing technologies, products, and services for the market; whereas Innovation cultivators are companies and organizations, such as incubators and co-working spaces, that support the growth of individuals, firms, and their ideas. These economic assets exist in UIDs in the forms of co-working spaces, technology companies, creative agencies, multi-media agencies, educational services, professional scientific and technical services, and informational and cultural industries. UIDs in Canada have active business associations and thriving start-up incubators that keep-track and update their business directories.

**Table 8. Economic assets sources**

|                         | Economic assets sources                  |
|-------------------------|--|
| Gastown                 | The Gastown Business Improvement Society |
| Exchange District       | The Exchange District BIZ                |
| The Innovation District | Communitech, Velocity, Google Map        |
| The Discovery District  | MaRS, Google Map                         |
| Cité du Multimédia      | n/a                                      |

In case of Cité du Multimédia, it was evident that there was a concentration of economic assets in creative fields, as media and architecture were present as the district employs approximately 6,000 workers in information-tech-related fields (Tremblay & Rousseau, 2005). However, the relevant information on all of the economic assets of the district could not be found in a credible way (see Table 8). Economic assets of Cité du Multimédia will be discussed further in detail in the next chapter of the paper.

### *ATTRACTING YOUNG TALENT*

With a concentration of amenities, proximity to the CBD enables exploitation of the production and consumption that cities offer (Zukin, 1982; Hall, 1998; Glaeser et al., 2001; Duranton & Puga, 2004) and positions firms to better compete for well-educated young talent. Cortright (2014) confirmed that young talented adults between the ages of 25 and 34 years old, with a Bachelor's degree or higher level of education, were increasingly living within close proximity to metropolitan areas and further fueling economic growth and urban revitalization.

The resource used to obtain the demographic information and education attainment (university certificate, diploma or degree at bachelor level or above) was Statistics Canada Census Profile (2016).

### **MIXED-USE DEVELOPMENT**

Various literature sources confirmed that the concept of UIDs implies mixed-use development. In many cases, it is found to be true (for example, Barcelona@22, Boston's South Waterfront, and the Brooklyn Navy Yard). This study further investigated how morphological elements may have had an impact on promoting mixed-use development. Common indicators that promoted mixed-land use in UIDs were urban block sizes, diversity in building sizes, and historic adaptive re-use.

### URBAN BLOCK

There are a variety of opinions on the ideal length and size of urban blocks (see Table 9). While of the vast majority of scholars support small urban blocks (for example, Siksna, 1997; Charlotte Department of Transportation, 2007), some prefer larger

**Table 9. Preferred and maximum urban block length for local streets**

| Reference                                     | Preferred urban block (m) | Maximum urban block length (m) |
|---|---------------------------|--------------------------------|
| T.G.M Guidebook (2000)                        | 90                        | 180                            |
| Australia (2000)                              | 120                       | 140                            |
| Charlotte Department of Transportation (2007) | 120                       | 300                            |
| Siksna (1997)                                 | 60-70                     | <200                           |
| Song and Knaap, 2004                          | 300                       | 550                            |

*summarized by Pakzad and Salari (2018)*

blocks; arguing that small urban blocks produce less diversity in terms of building shape and size (Vialard, 2011). This study aligned with the belief that a wide range of block sizes should be encouraged to promote a variety of land uses, resulting in the mixed-use neighbourhoods (Metrasys, 2012).

Siksna (1997) and Pakzad and Salari (2018) examined urban blocks on the neighbourhood scale. Siksna (1997) conducted a comparative study of block size and form in twelve North American and Australian city centres. Although there was no consensus on what the ideal or most sustainable urban block size was, this study adopts Siksna's (1997) categorization of urban block sizes. Block sizes were classified as small (under 10,000 m<sup>2</sup>), medium (10,000 to 20,000 m<sup>2</sup>), and large (over 20,000 m<sup>2</sup>).

## BUILDINGS

Diverse building sizes promote mixed-use development by allowing for diversified use of space for various rental values (Jacobs, 1961). The diversity of building sizes was analyzed using QGIS. All building polygons within the defined district boundary were selected to be calculated with the Field Calculator function in an Attribute Table. Selected polygons were calculated in the unit of the projection; in this case, the unit used was square-metres (m<sup>2</sup>)

## HISTORIC ADAPTIVE REUSE

Revitalizing the historic built fabric reconnects the community with the past and becomes a part of cultural heritage (Zaitzevsky & Bunnell, 1970). History and heritage culture of a place were one of the crucial categories of place brand element as it evoked place quality and culture (Zenker, 2011; Anholt, 2006; Grabow et al., 1995).

The retention of old buildings is also a crucial morphological element in promoting the architectural mix. Jacobs (1961), Hutton (2006), and Ho (2009) claimed that post-industrial building types had a certain synergy with innovative production. The historic adaptive reuse of UIDs was measured by the number of heritage buildings within the district.

The municipal heritage database provides a list of registered heritage buildings (see Table 10). The level of historic adaptive reuse of each UID was calculated by extracting the amount of registered heritage buildings from the municipal heritage data and finding the ratio by dividing it by the total number of buildings in the district.

**Table 10. Heritage database sources**

|                         | Heritage database                                    |
|-------------------------|--|
| Gastown                 | the Vancouver Heritage Register, City of Vancouver   |
| Exchange District       | Historical Buildings and Resources, City of Winnipeg |
| The Innovation District | Designated Heritage Properties, City of Kitchener    |
| The Discovery District  | Heritage Register, City of Toronto                   |
| Cité du Multimédia      | The Montréal heritage databases, City of Montréal    |

### LAND USE POLICY

Land use of UIDs was examined through implemented planning policies of the respective municipalities. This document analysis validated whether the hypothesized influence of morphological elements on mixed-use development was actually present in UIDs. The government policies included The Municipal Official Plan, The Municipal Strategic Plan, and The Zoning Bylaws; these were examined for their land use policy on UIDs (see Table 11). Documents were scanned for content pertaining to the land use of UIDs and relevant materials were noted and commented on.



**Table 11. Government documents related to land use of UIDs**

|                         | Consulted government document(s)  |
|-------------------------|---|
| Gastown                 | Zoning and Development Bylaw  |
| Exchange District       | Downtown Winnipeg Zoning Bylaw<br>Complete Communities Direction Strategy |
| The Innovation District | City of Kitchener Official Plan   |
| The Discovery District  | City of Toronto Official Plan   |
| Cité du Multimédia      | Montréal Master Plan  |

## **CONNECTIVITY**

### WALKABILITY

Walkability is a key urban-design concept, particularly in the study of street life intensities and transit-oriented urbanism (Cervero & Kockelman, 1997; Krizek, 2003; Lo, 2009). Walkability is related to many aspects of the urban environment; for example, innovation districts including permeability, land use mix, and density (Porta and Renne 2005; Moudon et al. 2006; Forsyth et al. 2008; Ewing and Handy 2009; Lin and Moudon 2010; Lee and Talen 2014). However, previous studies have focused on perceptions or attitudes of users rather than urban morphologies (Clifton, Livi Smith, and Rodriguez 2007; Ewing and Handy 2009; Páez 2013).

Brown et al. (2014) measured walkability using a *Walk Score*. *Walk Score* is a built-environment walkability metric used to assess proximity to destinations such as parks

and stores (Walk Score, 2014). *Walk Score* measured walkability based on the distance to amenities or walkable destinations of the given address. As a research tool, *Walk Score*'s reliability and validity were proven to be acceptable through previous studies (Carr et al., 2011; Duncan et al., 2011; Manaugh & El-Geneidy, 2011; Jilcott-Pitts et al., 2012; Hirsch et al., 2013). *Walk Score* awards points based on the distance to the nearest destination of each type (e.g., retail, recreational) using multiple data sources (e.g., Google, OpenStreetMap). The walkability points are summed and normalized and presented as a score of 0 to 100. For this study, the addresses of the approximate central location was selected to extract the *Walk Score* for each district (see Table 12).

**Table 12. Address used to extract Walk Score of UIDs**

|                         | Address used   |
|-------------------------|--|
| Gastown                 | Gassy Jack statue, 1 Water Street, Vancouver BC V6B 2H9          |
| Exchange District       | The Cube Stage, 127 King Street, Winnipeg, MB R3B 1H9            |
| The Innovation District | The Tannery, 151 Charles Street W, Kitchener, ON N2G 1H6         |
| The Discovery District  | MaRS Discovery District, 101 College Street, Toronto, ON M5G 1L7 |
| Cité du Multimédia      | Morgan Stanley, 700 Wellington Street, Montreal, QC H3C 3S4      |

## PERMEABILITY

Jacobs (1961) claimed that the notion of the urban scale binds permeability and urban grain as fine grain, and the scale of buildings increased options of routes for pedestrians and better use of functions. Figure-ground can expose the urban grain.

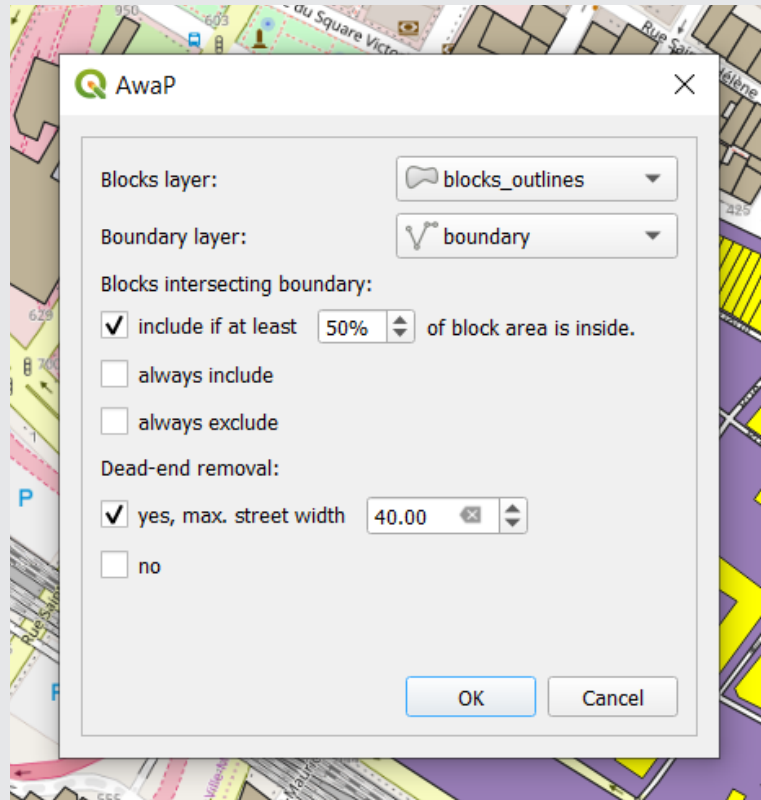
The research in this study attempted to measure the level of permeability of UIDs in Canada; to explore and compare the capacity of movement and interaction of selected urban spaces. Marshall (2005) defined permeability as the extent to which a particular urban morphology is permeated by publicly accessible space. It relate to the ease of movement and the potential to interact in an urban space. The measuring of permeability quantifies the ease of movement through an urban fabric. Pafka and Dovey (2017) proposed the area-weighted average perimeter (AwaP) as a way of measuring the permeability of urban fabrics. AwaP calculates the average perimeter of urban blocks within a study area. This method ensures the impact of a large block be proportional to the share of the study area it occupies. It also ensures that the large block's effect as a significant barrier to movement is not lost in the average. In algebraic terms this can be represented by the following formula:

$$AwaP = \sum_{i=1}^n P_i \times \frac{A_i}{A_T}$$

where  $n$  is the number of blocks,  $P_i$  and  $A_i$  are the perimeter and area of each block  $i$ , respectively, and  $A_T$  is the total area of all blocks. Low AwaP scores indicate high permeability within the measured area, while high scores indicate low permeability.

An AwaP tool is provided as a QGIS plugin. The plugin was developed in Python using the spatial computation libraries embedded in QGIS. The graphical interface of the tool was shown in figure 8. QGIS is a free and Open Source Geographic Information System that supports the viewing, editing, and analysis of geospatial data. The minimum required QGIS version for the plugin is 3.4.

**Figure 8. The graphical interface of the AwaP tool in QGIS 3.4**



While using the AwaP scores in urban morphology analysis, it was important to keep in mind that AwaP calculation does not account for underpasses and overpasses, which may constitute a significant type of pedestrian connection in some cities.

### ***FIGURE-GROUND MAP***

Mapping is not only a mimetic tracing of a territory; instead, it is a production of ideas (Wood & Dovey, 2015). While the maps are representations of empirical spatial

facts, they are also forming an intellectual agency, tools for the interrogation of data (Corner, 1999).

A map is critical in the analysis of the urban form. Although maps can only show a static image from a given time, they could reveal morphological elements of the innovation districts in Canada by comparing the selected case studies. The use of maps enabled the researcher to examine the built environment's characteristics, and chart information for each district, including land uses, building structures, lot patterns, and street patterns.

Inspired by Jenkin's *To Scale* (2008), selected case studies were compared on the same scale. Figure-ground mapping is the primary method to undertake and communicate morphological elements of an urban form in research. Figure-ground mapping can illustrate the relationship between built and unbuilt spaces, enabling a better understanding of relationships and patterns. In particular, this study utilized tissue studies to evaluate the urban form of five innovation districts in Canada in terms of their size and scales of space. Differences in street and block patterns, built density, the arrangement of buildings within lots, and permeability were the critical interest of this study.

For this study, maps of case studies were accessed through OpenStreetMap (OSM). OSM is an editable world map where users can create and retrieve data. It is a community-driven, open data source with an emphasis on local knowledge. Contributions from local mappers and GIS professionals and engineers, ensures the map is accurate and up-to-date (OpenStreetMap, n,d.). OSM was chosen as a preferred source as the researcher wanted to capture the current state of the selected

case studies.

Maps projecting the case studies' areas were exported as a Portable Document Format (.pdf) from OSM to be edited in a vector graphics editor software called Adobe Illustrator. Online sources, including both municipal and Google Earth, were consulted to identify the boundaries for each district. Each map was projected at the same scale for comparison purposes.

In this study, mapping was used to provide a visual aid in understanding space easily. A figure-ground, in the context of planning and architecture, is a visualization that highlights the distinction between built and open space (Bustamante, 2008). Critiques of the figure-ground argue that those figure-grounds are oversimplifications of the complexity of urban form (Sease, 2015); however, the figure-ground is a useful tool to communicate visual information about a space. It effectively visualizes morphological elements such as the relationship between open space and buildings, and the scale and pattern of developments.

## **CHAPTER 4**

### **ANALYSIS AND FINDINGS**

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UIDs portray a particular image of a place. A mash-up of entrepreneurs, research institutions, and start-ups in a compact urban form, UIDs feature spaces that are extensions of the office base (Martins, 2015) in a technologically-wired mixed-use development connected by public transit and bike-sharing programs. These spaces not only enable work to be physically dispersed, but also satisfy the prevalence of small firms and freelancers, placing a premium on networking with like-minded people (Storper & Venables, 2004; Martins, 2015).

In this chapter, place characteristics of UIDs — compactness, mixed-use development, and connectivity — were examined using identified indicators in the Research Methodology chapter.

#### **4.1 COMPACTNESS**

High density is one of the most common indicators in defining the compactness of urban form. High densities are associated with urban vitality and creativity (Haughton & Hunter, 1994) and are credited with creating more dynamic urban districts (Taylor & Nostrand, 2008).

Density can be measured in terms of population (gross density) and of the built form (net density). For the study of UIDs, this paper suggested that the density of resources

was critical. It measured the density of economic resources with their proximity to the Central Business District (CBD), and the density of social resources with the concentration of young talent. Before discussing the density and the compactness of UIDs, it is worth knowing the scale of the districts.

Despite being an important economic driver of the city, UIDs only occupied a fraction of the land area; accounting for 0.1 to 0.3 percent of the city’s land area. The selected case studies varied in size, ranging from 0.17 km<sup>2</sup> in Gastown, Vancouver to 0.45 km<sup>2</sup> in the Discovery District of Toronto (see Table 13). To put this into perspective, the entire case studies’ area can fit twice within Central Park in New York (land area of 3.41 km<sup>2</sup>).

**Table 13. Land area of UIDs in Canada**

|                                      | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|--------------------------------------|---------|-------------------|---------------------|--------------------|--------------------|
| District area (km <sup>2</sup> )     | 0.17    | 0.32              | 0.35                | 0.45               | 0.26               |
| Relation to the size of the city (%) | 0.1     | 0.1               | 0.3                 | 0.1                | 0.1                |

**GROSS DENSITY (POPULATION DENSITY)**

It was observed that UIDs in Canada tend to have a much higher population density compared to the respective city’s average density per km<sup>2</sup> (see Table. 14). The only exception occurred in the Discovery District of Toronto, where research institutions



and hospitals occupied the majority of the district. High population density indicates the compactness of UIDs. It also indicates that UIDs are not simply an employment quarter, but also a vibrant living neighbourhood.

**Table 14. Population density (gross density) of UIDs in Canada**

|  | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|--|---------|-------------------|---------------------|--------------------|--------------------|
| <b>Population density of the district (per km<sup>2</sup>)</b> | 20,725  | 2,402             | 2,085               | 2,161              | 7,644              |
| <b>Population density of the city (per km<sup>2</sup>)</b>     | 5,493   | 1,519             | 1,705               | 4,334              | 4,662              |
| <b>Relation to the density of the city (%)</b>                 | 377     | 158               | 122                 | 50                 | 164                |

High population density of UIDs indicates that they are a healthy district that promotes innovation - as density is credited for encouraging the knowledge spillover. Density increases the ease and frequency of social interaction within the district (Storper & Venables, 2004).

**NET DENSITY (DENSITY OF BUILT FORM)**

The built-form-density appeared to generate similar patterns compared to population density (see Table 15). However, it is worth noting that the Innovation District of Kitchener showed a significant increase. Only 20 percent of the total area is developed, which could indicate the presence of high-rise residential buildings.

**Table 15. Density of built forms (net density) of UIDs in Canada**

|   | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|---|---------|-------------------|---------------------|--------------------|--------------------|
| <b>Net density of the district (per km<sup>2</sup>)</b>   | 39,144  | 5,915             | 10,429              | 4,860              | 16,683             |
| <b>Ratio of built area to the total district area (%)</b> | 53      | 41                | 20                  | 44                 | 46                 |

High population and built-form density of UIDs may indicate an increased chance of face-to-face interaction. From this, several hypotheses can be developed. The first is that the co-location of innovative industries in predefined districts promotes high levels of social, functional, and formal diversity. The second is that a particular urban morphology encourages a dense and walkable environment, encouraging face-to-face encounters with other people.

### ***CONCENTRATION OF RESOURCES***

It is widely acknowledged that a rising number of innovative firms are choosing to congregate and co-locate in compact and amenity-rich enclaves in the core of cities (Hutton, 2004; Bugliarello, 2004; Florida, 2014; Morisson, 2015).

According to Katz and Wagner (2014), most IDs adhere to one of the three general models; those being the anchor plus, the re-imagined urban areas, and urbanized science park. For this study, IDs in an urban environment were examined. Thus, the models of “anchor plus” and the “re-imagined urban areas” were used to categorize

selected case studies in Canada (see Table 16).

**Table 16. District typology of selected case studies**

|                       | <b>Gastown</b>          | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|-----------------------|-------------------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>District model</b> | re-imagined urban areas | re-imagined urban areas  | anchor plus                | anchor plus               | re-imagined urban areas   |

In the Canadian context, UIDs in Vancouver, Winnipeg, and Montréal applied the “re-imagined urban areas” model while IDs in Kitchener and Toronto applied the “anchor plus” model

Vancouver’s Gastown, Winnipeg’s Exchange District, and Montréal’s Cité du Multimédia showed characteristics of the “re-imagined urban areas” model. Once-forgotten fabrics of the respective city, these areas feature former industrial districts regenerated physically and economically. Its proximity to downtown, and the appeal of nearby waterfronts and historic buildings stocks, are drawing smaller tech companies and its workers.

The “anchor plus” model was primarily found in downtown and mid-town areas, where massive-scale, mixed-use development is centred around major anchor institutions, entrepreneurs, and companies involved in the commercialization of innovation.

The Discovery District of Toronto was anchored by major institutions such as the University of Toronto, Toronto General Hospital, and MaRS. Likewise, the Innovation

District of Kitchener featured a collection of major anchor institutions - such as the University of Waterloo, Google, Communitech and Velocity (Google map, 2020).

## **CONCENTRATION OF ECONOMIC RESOURCES**

### PROXIMITY TO CBD

UIDs in Canada embrace cityness (Sassen, 2008). Cityness refers to the urbanism attributes of complexity, density, diversity of people and cultures, and a layering of the old and the new. They also approve the known cluster-identity-forming mechanism (Nathan, 2018) of the tendency of smaller-tech firms clustering in inner urban space (Scott, 1997; Hall, 2000; Hutton, 2008). All five of the selected case studies in the Canadian context were in proximity to the urban core of each respective city. On average, they were found within 1.2 kilometres from the CBD (see Table 17).

**Table 17. Proximity to the CBD**

|   | <b>Gastown</b> | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|---|----------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>Proximity to the urban core (km)</b> | 1.1            | 0.5                      | 0.8                        | 1.9                       | 1.3                       |

The urban location of UIDs — in proximity to the CBD — enables them to exploit the production and consumption that cities offer (Zukin, 1982; Hall, 1998; Glaeser et al., 2001; Duranton & Puga, 2004). High density and proximity to the CBD indicates that UIDs are urban communities with amenities supporting everyday life within a walkable distance.

## ECONOMIC ASSETS

Traditional economic developments have been emphasizing the commercial aspects (i.e. housing, retail, sports stadiums) in urban revitalization efforts. In contrast, UIDs grow firms and networks by leveraging distinct economic strengths for each city. Entrepreneurs and start-ups play an important role in urban job growth (Katz & Wagner, 2014). Table 18 shows the concentration of economic assets, specifically innovation drivers and innovation cultivators, of UIDs in Canada.

Economic assets of Gastown and the Exchange District exist in the form of small-scale firms and start-ups. 89% and 92% of economic assets in Gastown and the Exchange District respectively were innovation drivers that were focused on developing innovative products and services to the market. In the Exchange District, the presence of large-scale innovation drivers was increasing as key anchor institutions. Tech companies such as Ubisoft and Skip-the-Dishes were moving to the Exchange District.

In contrast, economic assets of the Innovation District in Kitchener had a very strong presence of innovation cultivators. Communitech and Velocity support the growth of 200 individuals and firms - and their ideas. The District also had a very strong presence of innovation drivers, featuring Google's Canadian headquarters and medical research institutions - the University of Waterloo's School of Pharmacy and the Centre for Family Medicine in McMaster University.

Similar to the Innovation District, the Discovery District's key anchor tenant was an innovation cultivator, which supported more than 120 start-ups in a variety of fields - including medical, information and communications technology, engineering, and social innovation. Aside from MaRS, the Discovery District was dominated by

innovation drivers in the medical field, including Toronto General Hospital, the Hospital for Sick Children, and University of Toronto’s Bahen Centre for Information Technology.

Although not officially counted, economic assets of Cité du Multimédia existed in the form of innovation drivers (including the world-renowned creative agency) such as Sid Lee, and an international medical device manufacturer - Zimmer Biomet. Also, the area was home to the Association Quebecoise des Technologies, a hub for the technology network/scene in Quebec with 500 members related to Technology (AQT, n.d.).

**Table 18. Economic assets of UIDs in Canada**

|  | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|--|---------|-------------------|---------------------|--------------------|--------------------|
| <b>Economic Assets (Kats &amp; Wagner, 2014)</b>             | 124     | 197               | 252                 | 127                | n/a                |
| <b>Concentration of Economic Assets (per km<sup>2</sup>)</b> | 729     | 616               | 720                 | 282                | n/a                |

UIDs in Canada feature a high concentration of economic assets (see Table 18). However, the economic assets alone do not indicate the strength of the district (Katz & Wagner, 2014). For example, the Innovation District in Kitchener had a healthy number of economic assets, but lacked in physical assets. The Innovation District had the lowest ratio of built area among the selected case studies. This imbalance could be explained by the fact that the Innovation District has room to grow, but needs better

planning or redesigning of the physical realm to reach its potential. In contrast, the Discovery District of Toronto possessed a strong set of physical assets in terms of the net density, but lacked in economic assets compared to other UIDs in Canada. Gastown and the Exchange District appeared to be a stronger community with both strong physical and economic assets.

**ATTRACTING YOUNG TALENT**

UIDs offer an appealing living environment for the innovation-driven demographic. Not only does it provide mixed-income housing and smaller, more affordable spaces for start-ups, but UIDs are also filled with amenities such as medical offices, grocery stores, cafes, and restaurants. Also, they offer entertainment and a cultural scene (Roemberg, 2018; Turrell et al., 2013; Yamada et al., 2012). By offering an urban lifestyle within an amenity-rich, mixed-use urban neighbourhood, UIDs are positioned to better compete for well-educated, young talent.

**Table 19. Young talents of UIDs in Canada**

|  | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|--|---------|-------------------|---------------------|--------------------|--------------------|
| <b>25 to 34-year-olds in UIDs (%)</b>            | 26      | 18                | 30                  | 21                 | 33                 |
| <b>25 to 34-year-olds in respective city (%)</b> | 20      | 15                | 16                  | 17                 | 17                 |

It was observed that the urban location of UIDs in Canada attracted young persons aged between 25 to 34-years-old. Compared to their respective cities, the ratio

of young people living in UIDs was much higher. The difference was much more noticeable in cities located in the East of Canada, such as Kitchener and Montréal (see Table 19).

Interestingly, the education-attainment level among residents of UIDs also showed regional differences (see Table 20). One contributing factor may have been that UIDs in Kitchener, Toronto and Montréal focused on specialized high-tech and research institutions where Gastown and the Exchange District’s industry landscape featured a more general mix of creative services.

**Table 20. Educational attainment level of UIDs in Canada**

|   | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|---|---------|-------------------|---------------------|--------------------|--------------------|
| Educational attainment level of residents (25 to 64-year-olds) in UIDs (%)            | 37      | 27                | 44                  | 69                 | 71                 |
| Educational attainment level of residents (25 to 64-year-olds) in respective city (%) | 47      | 33                | 27                  | 44                 | 39                 |

## 4.2 MIXED-USE DEVELOPMENT

### ***DIVERSITY IN URBAN BLOCK SIZE***

UIDs in Canada featured urban forms comprised of various sizes and lengths of urban blocks (see Table 21). Urban blocks in UIDs range from very small blocks (smaller than



200 m<sup>2</sup>) to large blocks that extend to bigger than 60,000 m<sup>2</sup>.

**Table 21. Urban blocks of UIDs in Canada**

|  | <b>Gastown</b> | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|--|----------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>Small (%)</b>                                 | 94             | 84                       | 42                         | 11                        | 68                        |
| <b>Medium (%)</b>                                | 6              | 14                       | 29                         | 39                        | 32                        |
| <b>Large (%)</b>                                 | 0              | 2                        | 29                         | 50                        | 0                         |
| <b>Suitable (%)</b>                              | 94             | 52                       | 71                         | 44                        | 76                        |
| <b>Long urban block (&gt;180m in length) (%)</b> | 9              | 10                       | 41                         | 56                        | 26                        |

As discussed earlier in the paper, (see Table. 9, p.55 of this paper), there were different values of the preferred urban block's length. In this paper, the maximum urban block length of 180m was chosen. Among 143 urban blocks in UIDs in Canada, 33 urban blocks were longer than 180 m. Gastown, the Exchange District, and Cité du Multimédia featured a fine urban grain composed of many small-sized street blocks. Short blocks increased visual permeability. It was easier to see from one junction to the next in all directions, improving people's awareness of the choice available. High-levels of permeability in UIDs creates a sense of intimacy and coziness; it is safer to walk and interact with strangers (Hutton, 2006; Rantisi, Leslie, & Christopherson, 2006).

UIDs in Canada were predominantly comprised of small urban blocks (under 10,000 m<sup>2</sup>). 68% of the urban blocks were considered small. Districts categorized as re-imagined urban areas featured urban forms with small urban blocks, compared to the urban forms of the districts that fell under the anchor plus model. In terms of balance, the Innovation District in Kitchener had the most-balanced ratio in terms of the size of urban blocks in all UIDs in Canada.

Moudon (1986) suggested that smaller lot sizes help to produce more diverse, resilient urban environments. She believed that “by ensuring that property remains in many hands, small lots bring important results, many people make many decisions, thereby ensuring variety in the resulting environment” (p. 188).

Although many scholars prefer small urban blocks, small blocks produce less diversity in terms of building shape and size (Vialard, 2011). A diverse range of urban blocks encourages variety of land uses promoting a mixed-use development (Metrasys, 2012).

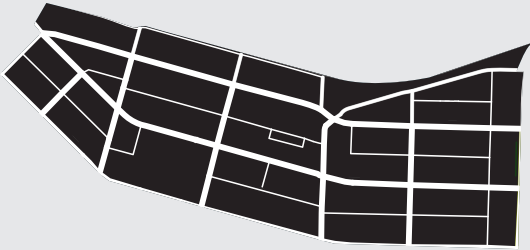
Siksna (1997) claimed that small to medium size blocks, in the range of 3,600 m<sup>2</sup> to 20,000 m<sup>2</sup>, were more suitable for the general functionality of city centres than larger blocks. According to that measure, 69% of urban blocks in UIDs in Canada were suitable. Gastown in Vancouver’s urban form was comprised of 94% of suitable-sized urban blocks; whereas, the Discovery District in Toronto’s urban form only featured 44% of suitable-sized urban blocks.

### ***STREET AND URBAN BLOCKS OF INNOVATION DISTRICTS***

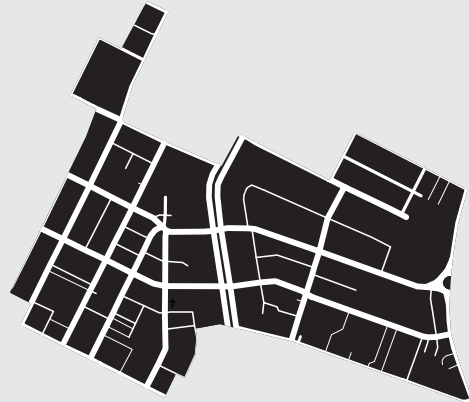
The street pattern establishes the main elements of the public space network,

**Figure 9. Street and block patterns of UIDs in Canada**

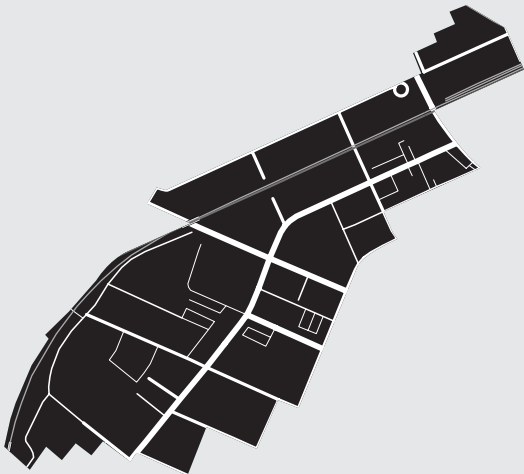
**A**



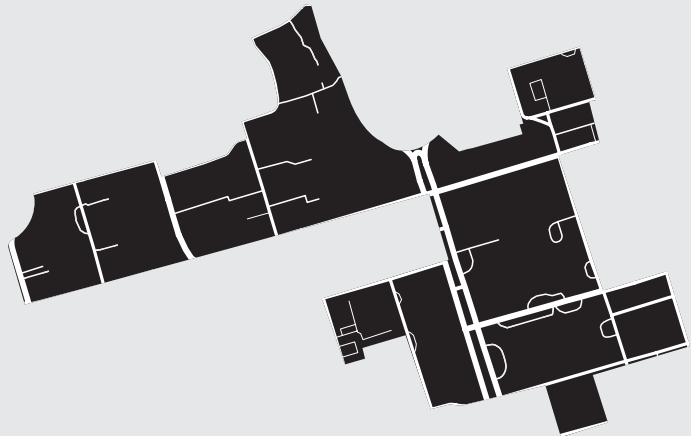
**B**



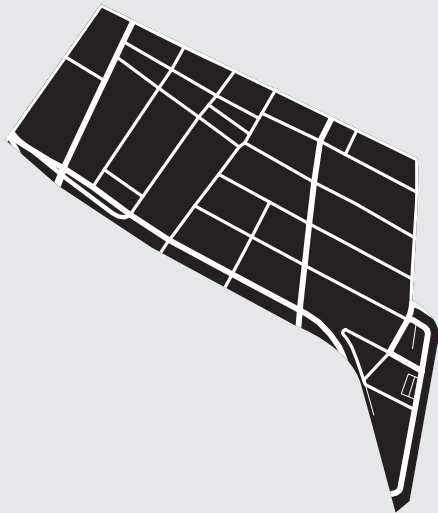
**C**



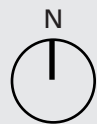
**D**



**E**



- A. Gastown**
- B. Exchange District**
- C. Innovation District**
- D. Discovery District**
- E. Cité du Multimédia**



— 200m

facilitating and accommodating the overlapping realms of movement space (vehicular circulation) and social space (pedestrian movement). When the principal modes of transport are by foot, the realms of movement and social space overlap considerably. However, modern urban streets became roads suppressing the street's social aspects in favour of movement and circulation of vehicular traffic. This separation of pedestrian movement from vehicular movement occurred through the introduction of sidewalks. UIDs in Canada emphasized quality-of-life in their streets by rediscovering streets as both social places and connecting elements in an urban environment (Appleyard 1981; Moudon 1987; Hass-Klau 1990; Jacobs 1995; Loukaitou-Sideris & Banerjee 1998; Hass-Klau et al. 1999; Banerjee 2001; Jacobs et al. 2002).

UIDs in Canada presented elements of the ideal urban block. UIDs in Vancouver, Winnipeg and Montréal presented typologically-viable, urban blocks that were small in length and width. They formed many well-defined streets and squares in the form of a multi-directional horizontal pattern of urban spaces (Krier, 1984). These UIDs had a highly permeable urban environment that allowed for greater freedom of movement, creating more significant opportunities for street frontages, paths, and openings. This maximized economic and socio-cultural activity within the district, encouraging face-to-face encounters with other innovative persons in the district (Moughtin et al., 2003; Wood & Dovey, 2015).

UIDs are a responsive urban environment; treating the streets as an aesthetic, visual element and supporting social interaction while accommodating and integrating the demands and needs of the various movement systems. As Bentley et al. (1985) said: "Only places which are accessible to people can offer them the choice. The extent

to which an environment allows people a choice of access through it, from place to place, is, therefore, a key measure of its responsiveness (p. 27).”

### ***BUILDINGS DEFINING SPACE AND BUILDINGS IN SPACE***

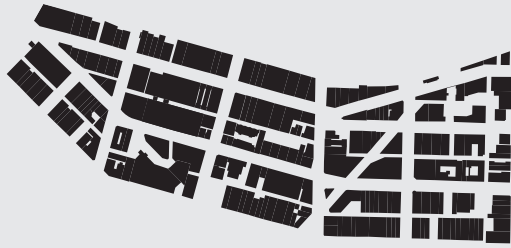
The placement of buildings in lots and along streets is one of the central and defining components of how a place functions and feels. Meiss (1990) blamed the breaking down of the urban block system on the multiplication of objects and the neglect of *fabrics*. The cohesiveness of space was observed through figure-ground mapping (figure 10).

The urban fabric of Gastown, the Exchange District, and Cité du Multimédia could be characterized as traditional urban spaces, as they present a relatively densely built environment where buildings are built adjacent to one another, providing the walls of open space. In the plans of Gastown, the Exchange District, and Cité du Multimédia, buildings were constituent elements of generalized, highly-connected urban blocks. In those districts, buildings defined streets and squares and promoted a small-scale and finely-meshed street grid. In the plans of the Innovation District and the Discovery District, buildings were separate, freestanding objects; standing in a more generalized type of space. Freestanding buildings promoted a coarsely-meshed road grid within a superblock system.

In contrast, the Innovation District and Discovery District were characterized by freestanding buildings influenced by the Modernist design. Buildings in these districts were designed inside-out; in response to their functional requirements and considerations of elements - such as light, air, and movement - the buildings

Figure 10. Arrangement of buildings of UIDs in Canada

A



B



C



D

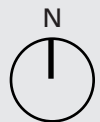


E



- A. Gastown
- B. Exchange District
- C. Innovation District
- D. Discovery District
- E. Cité du Multimédia

200m



became an “object in space”. Rather than being closed and contained by buildings, the Modernist urban space intends to flow freely around buildings; treating the traditional street as “no more than a trench that causes oppression by constriction of the enclosing walls” (Le Corbusier in Broadbent, 1990, p. 129).

As was discussed, UIDs in Kitchener and Toronto featured characteristics of a Modernist urban space. These environments were laid out to accommodate transportation needs, such as trains and automobiles. Notably, the Innovation District of Kitchener demonstrated the fundamental problem of twentieth-century urbanization – the multiplication of objects neglecting the fabrics (Meiss, 1990). Freestanding buildings in the Innovation District were physically-separated, tall, and are all architecturally distinctive. Such developments caused fracturing of space (Lefebvre, 1991), featuring a series of isolated monuments surrounded by roads and parking lots (Hebbert, 2008). Its characteristic freestanding objects within a large block competed with the street privatizing public life (Krier, 1990). As a result, the Innovation District of Kitchener, when compared to other UIDs in Canada, lacked the spatial coherence that other urban innovation districts across Canada possessed.

### ***DIVERSITY IN BUILDING SIZE***

An urban form featuring various building types and sizes promotes diversified mixed-use. Diversified mixed-use allows the urban form to be more permeable, drawing people of various income levels and creates a vibrant urban street life (Jacobs, 1961). Such urban environments attract innovative industries that are diverse in their size and type, to co-locate in districts with a high level of social, functional, and architectural mix.

**Table 22. Diversity of building size of UIDs in Canada (in %)**

|   | Gastown | Exchange District | Innovation District | Discovery District | Cité du Multimédia |
|---|---------|-------------------|---------------------|--------------------|--------------------|
| <b>Small (&lt;500 m<sup>2</sup>)</b>    | 59      | 54                | 57                  | 15                 | 52                 |
| <b>Medium (501-1,000 m<sup>2</sup>)</b> | 31      | 29                | 15                  | 17                 | 18                 |
| <b>Large (&gt;1,000 m<sup>2</sup>)</b>  | 10      | 17                | 28                  | 68                 | 31                 |

UIDs in Canada featured various sizes of buildings (see Table 22). The building sizes may have been influenced by the urban block sizes of UIDs. With the exception of the Discovery District in Toronto, small- and medium-sized buildings dominated the urban form of UIDs. Smaller buildings allowed for the creation of smaller and affordable spaces for start-ups, and indicated opportunities for smaller local retail stores - along with the availability of housing (ranging in rental price) and further encouraged diversified land use.

### ***HISTORIC ADAPTIVE REUSE***

The retention of old buildings is also a crucial morphological element in promoting the architectural mix. UIDs in Canada featured a strong aspect of historic adaptive reuse, a critical element of the cultural heritage of a place (see Table 23).

The level of historic adaptive reuse in UIDs in Canada ranged from 4% to 75% (see Table. 24). Gastown, the Exchange District, and the Discovery District featured the



highest level of historic adaptive reuse; 61 to 75% of the buildings in those districts were registered as heritage buildings.

**Table 23. Historic adaptive reuse in UIDs in Canada**

|                                | <b>Gastown</b>         | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|--------------------------------|------------------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>Historic adaptive reuse</b> | National Historic Site | National Historic Site   | Yes                        | Yes                       | Yes                       |

**Table 24. Heritage buildings of UIDs in Canada**

|  | <b>Gastown</b> | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|--|----------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>Number of Registered Heritage Building in UID</b> | 143            | 120                      | 7                          | 36                        | 5                         |
| <b>Total number of building in UID</b>               | 214            | 161                      | 66                         | 59                        | 124                       |
| <b>Level of historic adaptive re-use in UID (%)</b>  | 67             | 75                       | 11                         | 61                        | 4                         |

**LAND USE POLICY**

Earlier investigations focused on how morphological elements may have influenced the encouragement of mixed-use urban environments. Study of land use in UIDs revealed that the mixed-use nature of UIDs was strategically supported by municipal planning policies. All UIDs, but for the Discovery District, were designated as mixed-use areas by their respective cities (see Table. 25).

**Table 25. Permitted land uses of UIDs in Canada**

|                            | Permitted Land Uses   |
|----------------------------|---|
| <b>Gastown</b>             | <ul style="list-style-type: none"> <li>▪ dwelling</li> <li>▪ retail</li> <li>▪ office</li> <li>▪ institutional</li> <li>▪ manufacturing</li> <li>▪ wholesale</li> </ul>   |
| <b>Exchange District</b>   | <ul style="list-style-type: none"> <li>▪ dwelling</li> <li>▪ commercial sales and service</li> <li>▪ office</li> <li>▪ public &amp; institutional</li> <li>▪ cultural &amp; entertainment</li> <li>▪ park</li> <li>▪ light industrial</li> </ul>  |
| <b>Innovation District</b> | <ul style="list-style-type: none"> <li>▪ offices (particularly research and high-tech offices and creative industries)</li> <li>▪ institutional</li> <li>▪ residential</li> <li>▪ studios</li> <li>▪ exhibition and/or conference facilities</li> <li>▪ existing light industrial employment</li> <li>▪ complementary commercial uses (i.e. restaurants, bars, personal services, craftsman shops, commercial entertainment)</li> </ul> |
| <b>Discovery District</b>  | <ul style="list-style-type: none"> <li>▪ universities</li> <li>▪ hospitals</li> <li>▪ associated research facilities</li> </ul>   |
| <b>Cité du Multimédia</b>  | <ul style="list-style-type: none"> <li>▪ housing</li> <li>▪ retail</li> <li>▪ office buildings</li> <li>▪ commercial buildings</li> <li>▪ buildings housing light industry</li> <li>▪ public or institutional facilities</li> </ul>   |

Gastown is governed under a special land use designation as a HA-2 (Gastown Historic Area) zone. The particular land use designation has been implemented by the City to

ensure the maintenance of Gastown's historical and architectural character (City of Vancouver, 2013).

The City of Winnipeg's *Complete Communities Direction Strategy* (2011) puts emphasis on the Exchange District in facilitating the adaptive reuse of heritage buildings in support of increased residential and mixed-use development. Specifically, Direction 5 of the Strategy calls to enhance the viability of the Exchange District; envisioning the District as a vibrant area of conserved heritage and an exciting place to live, work, and visit (City of Winnipeg, 2011).

The City of Kitchener has a special land use policy for the Innovation District. Under the umbrella of the Urban Growth Centre, the Official Plan encourages the conversion of industrial buildings to loft-style office and residential uses. The Official Plan also anticipates the Innovation District to be a regional transportation hub (City of Kitchener, 2014).

The City of Toronto's Official Plan designates the area of the Discovery District as Institutional Areas. The intention of the Institutional Areas is to encourage an innovation environment by clustering universities, hospitals, and associated research facilities (City of Toronto, 2019). Thus, the focus of the area is to be a major player in hosting employers and service providers, rather than focusing on being mixed-use within the District. A high Walk Score indicates the special context of such UIDs in Toronto as it has plenty of amenities within walking distance to support the District.

The City of Montréal designates the areas of Cité du Multimédia as a Mixed-Use Area. According to the Master Plan (2013), Mixed-Use Areas refer to the diversified areas comprising a variety of activities and housing.

## 4.3 CONNECTIVITY

UIDs feature a high level of interactivity between nodes within a network (Katz & Shapiro, 1985; Liebowitz & Margolis, 1994). The high-level of activity within a network in UIDs creates a sense of intimacy and coziness, providing easy walkability within pedestrian-friendly streetscapes - creating the feel of an urban village (Hutton, 2006). Frequent physical interaction within a network makes UIDs a place of trust or a socialized environment where it is safer to take risks (Rantisi, Leslie, & Chirstopherson, 2006).

### **WALKABILITY**

UIDs in Canada are very walkable environments (see Table. 26). The *Walk Score* of UIDs in Canada ranged from 92 to 99. According to *Walk Score*, points over 90 are categorized as *Walker's Paradise* (Walk Score, 2014). In an environment with over 90 points of *Walk Score*, daily errands do not require a car. High scores across the board indicated the locational benefit of UIDs being in close proximity to resources and amenities. It aligned with the findings of Brown et al. (2014) that proximity to the CBD was associated with more considerable amounts of purposive walking.

However, the *Walk Score* contradicted an earlier argument that smaller blocks promoted greater walkability. The Discovery District — the highest *Walk Score* and *Transit Score* recipient — was found to be comprised of the highest number of large blocks over 180 m long and featured the lowest density among UIDs.

**Table 26. Walkability of UIDs in Canada**

|                      | <b>Gastown</b> | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|----------------------|----------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>Walk Score</b>    | 97             | 97                       | 92                         | 99                        | 98                        |
| <b>Transit Score</b> | 100            | 91                       | 66                         | 100                       | 92                        |
| <b>Bike Score</b>    | 95             | 75                       | 75                         | 73                        | 100                       |

In addition to the *Walk Score*, each district was measured for its *Transit Score* and *Bike Score* to analyze their connectivity. *Transit Score* measures the district’s connectivity to the rest of the city by public transit, and *Bike Score* measures the suitability of an area for biking.

Again, the measure of the *Transit Score* and *Bike Score* does not appear to have a direct correlation with the urban block size and the length of urban blocks. This showed that the connectivity of UIDs can be increased by the city’s effort and investment in public transportation and bike infrastructures.

### ***PERMEABILITY***

Conceived as a public space network, the urban blocks are the result of connecting streets (Kropf, 2006). The street pattern and urban blocks determine and set the parameters for movement and development, contributing to the place’s characteristics. UIDs in Canada featured various block sizes, encouraging a greater diversity of building types and land uses (Love, 2009). Smaller blocks increased pedestrian permeability, walkability, and the social use of space, while larger blocks allow for flexibility of built form and open space. According to Krier (1990), small

blocks increased urbanity creating an environment of urban culture, of intense social, cultural, and economic exchange (p. 198). Being established in post-industrial sites gives these districts an advantage in creating an urban environment with diverse urban block sizes. Development of UIDs worked with the existing patterns of previous urbanizations. They reintegrated isolated fragments and re-established or created new linkages with the broader context to facilitate movement and to connect and integrate the new development with the surrounding context.

Next, the area weighted average perimeter (AwaP) was measured and applied to the five case studies (see Table 27).

**Table 27. AwaP of UIDs in Canada**

|             | <b>Gastown</b> | <b>Exchange District</b> | <b>Innovation District</b> | <b>Discovery District</b> | <b>Cité du Multimédia</b> |
|-------------|----------------|--------------------------|----------------------------|---------------------------|---------------------------|
| <b>AwaP</b> | 701.5          | 661.8                    | 1048.5                     | 1081.4                    | 658.1                     |

AwaP scores of UIDs in Canada ranged from 1,081 in the Discovery District to 658 in the Cité du Multimédia. Low AwaP scores indicated higher permeability within the measured area, while high scores indicated lower permeability.

It is interesting to note the contrasting result of walkability and permeability. The Discovery District (the highest Walk Score recipient) was found to be the least-permeable built environment. Measuring permeability reconnects urban morphological findings of urban blocks to place characteristics of connectivity in UIDs.

## **CHAPTER 5**

### **RECOMMENDATIONS AND CONCLUSION**

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#### ***SUMMARY***

This study investigated the urban morphology of UIDs in the Canadian context to provide insights into how physical urban form influences compactness, mixed-used, and connectivity of a place.

This study took an explanatory approach to analyze five UIDs in the Canadian context from the perspective of urban morphology, using mixed-use research methods. The comparison of UIDs was made by analyzing secondary sourced indicators. Further, this study supported quantitative findings of data analysis with qualitative spatial analyses using figure-ground maps.

The following sections revisit the thesis findings and discuss the contributions and recommendations for the future research.

#### ***RESEARCH FINDINGS***

UIDs' proximity to the urban core of respective cities enables them to exploit the production and consumption that cities offer (Zukin, 1982; Hall, 1998; Glaeser et al., 2001; Duranton & Puga, 2004). However, the economic assets alone do not indicate the strength of the district (Katz & Wagner, 2014). Compact and connected mixed-use development like UIDs can attract and retain young, talented adults between the ages of 25 and 34 years old that hold a bachelor's degree or higher level of education.

These young, talented adults are more commonly living within close proximity to metropolitan areas; fueling economic growth and urban revitalization (Cortright, 2014).

This study identified that UIDs are associated with images of a vibrant urban environment characterized by high density, walkable streets, and mixed-use developments. These favourable place characteristics are, in part, influenced by historic adaptive reuse within UIDs in Canada. Historic adaptive reuse of the former industrial warehouses and buildings promoted an architectural mix within the districts. This ultimately lead to various building types and sizes, which promoted diversified mixed-use (Jacobs, 1960). However, it is not possible to achieve that level of mixed-use in UIDs without adhering to government policies. Study of the land use in Canadian UIDs revealed that mixed-use developments are strategically supported by municipal planning policies.

This study also revealed the importance of building arrangement and the size of urban blocks. A place with freestanding buildings within a large block — the case of the Innovation District in Kitchener and the Discovery District in Toronto — lacked spatial coherence compared to a place where buildings were built adjacently to one another, providing walls of open space in a smaller block. Developments featuring freestanding buildings and superblocks caused fracturing of space (Lefebvre, 1991), featuring a series of isolated monuments surrounded by roads and parking lots (Hebbert, 2008). However, the research found that the walkability of a place did not appear to have a direct correlation with the urban block size and the length of urban blocks. It also proved that the connectivity of a place can be increased by the city's effort and investment in public transportation and bike infrastructures.



In contrast, smaller blocks — the case of Gastown in Vancouver, the Exchange District in Winnipeg, and Cité du Multimédia in Montréal — increased pedestrian permeability, walkability, and the social use of space. The AwaP scores of the UIDs proved this. UIDs in Vancouver, Winnipeg and Montréal produced low AwaP scores; this indicated higher permeability within the measured area. Figure-ground mapping of these districts visually showed urban blocks that were small in length and width, which allowed for greater freedom of movement, creating more significant opportunities for street frontages, paths, and openings. Smaller blocks maximize economic and socio-cultural activity within a district, encouraging face-to-face encounters with other innovative people in the district (Moughtin et al., 2003; Wood & Dovey, 2015). According to Krier (1990), small blocks also increased urbanity — urban culture of intense social, cultural, and economic exchange.

The findings of UIDs in Canada confirmed that street patterns and urban blocks were crucial contributors to the characteristics of a place. Various block sizes encouraged greater diversity of building types and land uses (Love, 2009). Smaller blocks increased pedestrian permeability, walkability, and the social use of space; while larger blocks allowed for the flexibility of the built form and open space. Becoming established in post-industrial sites gave UIDs an advantage in creating an urban environment with diversified sizes of urban blocks. UIDs worked with the existing patterns of previous urbanizations, reintegrating isolated fragments and re-established or created new linkages with the broader context.

### ***RECOMMENDATIONS FOR FUTURE STUDIES***

The study contributed in forging a better theoretical and conceptual understanding

of how urban morphology could be incorporated into the placemaking process by focusing on exploring how the physical form affects the place characteristics. The UIDs proved to be valuable case studies since they shared a common place identity. However, to strengthen the understanding of how urban form influences the formation of the place identity, more studies are needed.

The principal value of this study is in its comparative nature. This study has paved the way for similar investigations covering urban morphology. One topic for future research could be the comparison of UIDs in other parts of the globe. In addition to the urban morphology analysis, a place branding analysis of UIDs could be useful. Future practitioners may categorize cases into where branding tools were used to create a district (i.e. Jurong Innovation District, Singapore), or whether branding was used to complement existing assets - and strengthening its position (i.e. Tech City, London).

Another topic for future research could be an urban morphological analysis of other mixed-use development projects built to revitalize the inner-city neighbourhoods. Examples of such development projects include design districts, entertainment districts, and university campuses.

Some other components to consider are: UIDs' economic contribution in terms of talent attraction and retention; the impact of the key anchor institution's brand to the place branding; and the possible butterfly effect of place branding and development, such as gentrification.

## **CONCLUSION**

UIDs may have started as one of the trendy economic development strategies to convey the innovative image of the cities. However, UIDs have proven to be a successful placemaking tool in building a dense, walkable, bike-friendly, and transit-oriented neighbourhood with a strong sense of place. This blending of urban planning and economic development gathers tech start-ups, incubators, and research institutions to one of the neglected post-industrial neighbourhoods. This seems to be a positive way of regenerating inner-neighbourhoods with rezoning, redevelopment, and adaptive re-use. Ultimately, the urban morphology of UIDs helped a place to become a platform for innovation, entrepreneurship, and economic growth (Kelly, Ruther, Ehresman, & Nickerson, 2016) in the midst of the economic transition toward a knowledge-based economy.

This study's exploration of five UIDs in Canada sheds light on the possibilities of integrating urban morphology into planning and placemaking practices. A strong understanding of an urban form complemented by a robust branding initiative, can result in a thriving urban strategy that creates an attractive urban fabric and promotes economic growth and social interaction.

In the end, the author hoped that the findings of the study are useful to practitioners who create and manage urban spaces. Finally, the author hoped that there will be more studies exploring the potential of integrating urban morphology to help inform better planning and place-making practices.

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