A Geographical Analysis of Potential National Hockey League Expansion Cities in Canada

To what extent do certain Canadian cities possess geographical characteristics suited for National Hockey League expansion?

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1. Introduction

The goal of this work is to identify the geographical factors contributing to a city's potential for National Hockey League (NHL) expansion. The comparative analysis, by means of a ranking, will analyse prospective cities for expansion with respect to current NHL HUB[1] cities in Canada, i.e cities that already host a team, with many geographical factors. Note that the ranking does not take into account all factors in the NHL's decision such as revenue potentials or market size, but focuses solely on geographical potential, typically the first step in considering expansion.

1.1 Research question

To what extent do certain Canadian cities possess geographical characteristics suited for National Hockey League expansion?

1.2 Geographical context

Sports geography

Sports geography is a specific branch of geography that appeared first in the late 19th century (Bale). This discipline deals with the interconnection and manifestation of sports and the spaces it occupies; it often exists as an interdisciplinary geographical study, including areas such as migration and infrastructure.

Urbanization is often connected with the geography of sports, whether this is the development of cities due to sports or the preexisting locations that host these sports. When looking from a causality perspective, urban geography can determine the location of professional

[1] A HUB is a centralized space with important power and is highly connected to many other via transportation systems. In this case, it will be used to describe cities that currently possess an NHL team.

sports with certain factors that contribute to increased potential, this is the phenomenon that is at the centre of the goal of this work.

Sustainable development is an important goal when looking at expansion within sports, especially at the professional level with long term tourism. While propagating the activity and impacting the surrounding geography, sports contribute to the sustainable development goals put in place by the United Nations (United Nations). Evaluating geographical factors contributing to sport expansion can serve as a model for the propagation of sports and sustainable development in other areas.

The National Hockey League in Canada and expansion

The NHL is a professional ice hockey organization. Today, there are 32 teams with 25 in the United States and 7 in Canada located in Calgary, Edmonton, Montreal, Ottawa, Toronto, Winnipeg, and Vancouver ("National"). NHL expansion has occurred in many waves, starting in the 1960s to a standstill when the league rested on 30 teams for almost the first two decades of the century (Klein). A new surge of expansions took place with the admission of the Vegas Golden Knights in 2017, followed by the Seattle Kraken in 2021.

With the success of these teams, there has been speculation of more expansion to come, possibly in Canada. This raises the question of contributing geographical factors in hosting an existing NHL team and whether or which Canadian cities' possess these factors and geographical potential.

1.3 Method of investigation

Area of investigation

While NHL expansion is speculative in the United States as well, this analysis will focus solely on Canadian cities. The three cities chosen to be analyzed for their potential, that are not currently NHL HUB cities, are:

1. Saskatoon, Saskatchewan
2. Quebec City, Quebec
3. Halifax, Nova Scotia

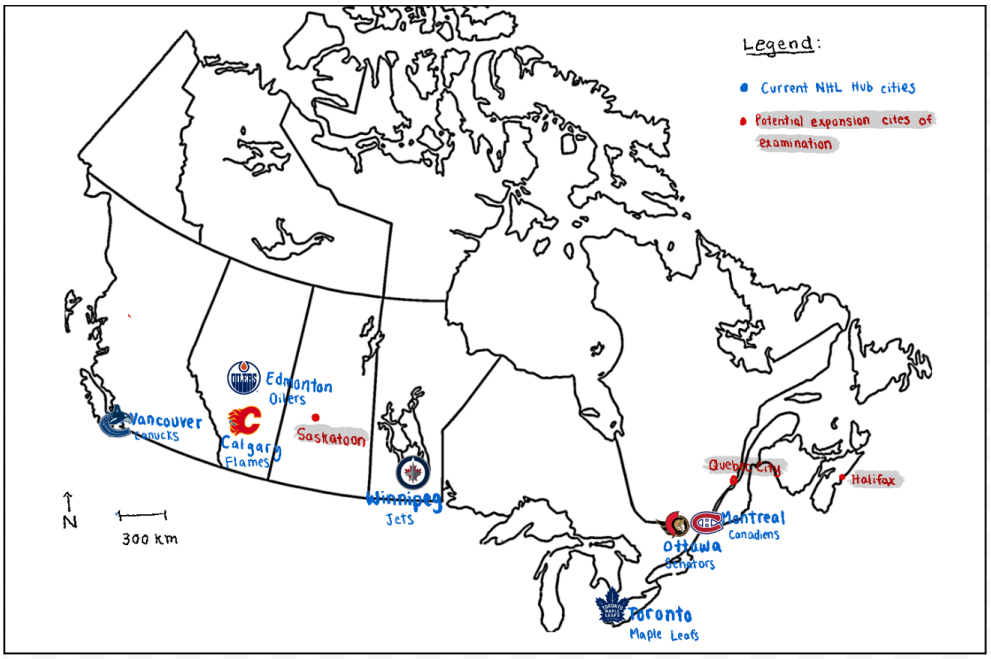

Figure 1. Current NHL HUB cities, with team names and logos, and potential expansion cities

Map created by author, logos from "Official Site of the National Hockey League | NHL.com." Www.nhl.com, www.nhl.com/info/teams/. Accessed 11 Sept. 2023.

These cities have been chosen as they present an important power within the country while being independent of other large agglomerations and some representing current gaps in the NHL landscape. Saskatoon, being the largest city in Saskatchewan and a significant factor in Canada's economy, presents factors that contribute to geographical potential for expansion ("Saskatoon"). Quebec City, a past NHL HUB city, the capital of Quebec, possesses important historic and touristic attractions as well as the power of being a port city on the St Lawrence River. In addition, the important demographic presence demonstrates its potential capacity for NHL expansion ("Quebec"). Finally, Halifax, which hosted the 2023 International Ice Hockey Federation World Junior Hockey Championship, is the capital of Nova Scotia and a major Atlantic port city of Canada, which above all presents a city with a passion for the sport of hockey. All these cities being capitals of their province also exposes their political power at the federal level.

It may be noted that Toronto suburbs are often examined as a potential expansion site in the future of the NHL. Being connected to or even a part of a preexisting NHL HUB city, its geographical potential has already been proven. Its economic validity is not the goal of this paper.

Ranking system

A ranking, including the 7 NHL HUB cities and 3 chosen potential cities, will be utilized as means of comparison between Canadian cities to determine whether they possess the geographical characteristics observed in current Canadian NHL HUB cities. This does not analyze the possible economic success if an NHL team were to be placed in that city but aims to be the initial hurdle in demonstrating expansion validity. This method was chosen over an index as

rankings provide relative positions and comparison while an index would be favorable to create a sort of benchmark which is unimportant in sports expansion.

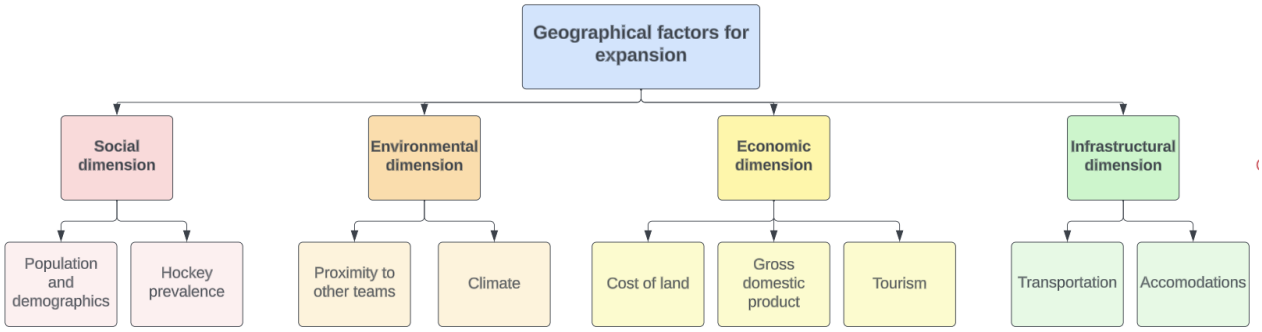

Figure 2. Diagram of factors taken into account in ranking system

Created by Author using Lucidchart, 2023

The ranking will take into account multiple dimensions including social, environmental, economic and infrastructural characteristics, each with multiple factors. For each factor, the cities will be ranked from 1 to 10 (7 NHL HUB cities and 3 potential expansion cities) based upon the data found. The average ranking for each dimension will then be used to calculate an overall average rank to give a comprehensive view of the geographic potential.

Hypothesis

I hypothesize that cities with important economies, existing amateur hockey presence as well as demographic presence at a national level will present the highest potential for NHL expansion.

Thus, I hypothesize that Quebec City will present the highest geographic potential for expansion, previously possessing an NHL team and presenting an important power in Canadian

geography. Second to Quebec City, I predict, will be Saskatoon, while the hockey prevalence may seem more limited than Halifax, Saskatoon has a more developed and higher infrastructural and demographic power.

Factors in assessing geographic potential and rankings

The following section is divided into 4 dimensions: social, environmental, economic and infrastructural. These dimensions have subsections which elaborate on specific data sets.

Social factors

Population and demographics

Population and demographic factors will be examined through the population, its growth in percentage as well as population density per square kilometer, using the Statistics Canada website (see Appendix A). Demographics is an essential indicator of NHL expansion, reflecting the soft power of an urban region. A mathematical modeling study at York University has identified that the larger a population, the more demand and an increased ease at which the social environment can create a stable fanbase (Light et al.). Population growth can be an indicator of the attractiveness of a city and help create a fanbase abroad, which can also promote a future NHL team.

Hockey prevalence

Hockey prevalence or culture within a city is essential for the geographic potential for expansion, demonstrating the potential for support of an NHL team and the sports culture in the city. The number of city rinks including indoor and outdoor, from each city's park and recreation website, as well as the average attendance for a Canadian Hockey League, CHL, team will be

taken into consideration (see Appendix B). The construction of arenas reflects the government and population's investment in the sport. The CHL attendance reflects the support attributed to junior hockey in the city, highlighting the hockey community and willingness to attend games. For cities without CHL teams, the closest team will be taken.

Environmental factors

Proximity to other teams

Overall travel distance, if a city were to be incorporated into the league, is a geographic logistical aspect that also ties into sustainable development. Simply for feasibility purposes, new NHL teams must be within a reasonable distance. A paper regarding professional soccer expansion highlights the same geographical theory in which increasing distance results in fewer fans, as in close proximity, 5% of attendance are visiting fans (Semmelroth et al.). However, *NHL Green* explains that from the perspective of UN sustainable development goals, having a team that is closer can reduce travel carbon footprint, one of their goals ("NHL Green"). The direct flight time to the closest existing NHL team will be utilized from Air Canada (see Appendix C).

Climate

Hockey, being a winter sport, is interconnected with the climate of a location. Climate contributes to a social environment in which the population is more likely to be familiar with the game and thus support the expansion (Light et al.). While extreme climates are often isolating for a city, the cities of interest do not fall under this category. The climate data site will be used to provide data for the median temperature from 2011 to 2040, a prediction following the UN SSP2-4.5 (see Appendix D). The SSP2-4.5 data is a prediction in which there would be a slow,

gradual increase in sustainability; projections add important data as this analysis focuses on prospective future expansion (Januta).

Economic factors

Cost of land

Cost of land is often an indicator of the smart power that a city possesses. Economic success of a city, a dynamic demographic scene, cultural power and interconnectedness are all reflected in the cost of land of a region, encompassing important characteristics for NHL growth. Moreover, the physical characteristics of the land play a part in this factor: it may potentially indicate the possibility of development within an already existing urban region. The Canadian Real Estate Association collects average real estate prices in each major Canadian city at the end of every month, this investigation will use the data from March 2023 as it is the most recent data available (see Appendix E).

Gross domestic product

Gross domestic product is a measure of economic influence and power. A city with a high gross domestic product is often multimodal and can sustain many economic activities, such as the addition of a professional hockey team. It may also indicate the attractiveness of a city and an existing reliable infrastructure. The Statistics Canada website will be utilized to determine the gross domestic product at basic prices by census metropolitan area (see Appendix F).

Tourism

Sports tourism and the leisure industry is an indicator of current cultural or soft power a city possesses. Tourism is closely related to interconnectedness and may help grow not only the league but expand the horizons of the sport. Sports tourism is approximately 10% of world tourism and generates over 800 billion dollars ("Sport Tourism - World Sport Tourism Show"). Domestic tourism is essential in the case of the NHL for increased attendance and fans growing the economies of host cities. The total domestic tourism visit expenditures from each city will be collected from the Statistics Canada website (see Appendix G).

Infrastructural factors

Transportation

In major cities, particularly HUBs, transportation infrastructure is vital. For the teams in a professional sports league, airports, specifically international, are important for its functioning. One paper highlights the importance of infrastructural logistics in professional sports including airports, such as for the Atlanta Olympics now the biggest airport in the world, and public transport such as for the London Olympic Games with over 1 billion dollars invested (Pott et al.). Therefore, the total number of passengers enplaned and deplaned from Statistics Canada will be used. Public transport, at the city scale, such as buses and trains can provide options for fans to commute to the location of the arenas. Thus, the percentage of population near public transit stops will be utilized to provide an insight into the connectedness of the city and how developed the transportation systems are (see Appendix H).

Accommodations

Hotels and accommodations are intertwined with the tourism industry, displaying a city's power and attractivity while also being crucial for visiting teams as well as fans from out of town. There is evidence that during professional sports events, the demand for hotels increases, which an expanding city must be capable of handling (Chikish et al.). The number of hotel rooms in each city will analyze the availability of accommodations (see Appendix I).

Calculations

In sum, for each dimension, the current and potential cities will be ranked from 1 (most potential) to 10 (least potential) for all the sets of data of interest described above. Then an average will be calculated for this specific dimension.

The final overall calculation of the geographic potential for expansion of each city will take the average rank for each dimension, being social, economic, environmental and infrastructural, and then calculate an overall average to ensure all dimensions are weighted equally despite varying numbers of factors.

2. Analysis

2.1 Data presentation for cities

The rankings of each factor for each city is present in the tables below. Each separate table is one dimension of the ranking, with the average rank for the city in the final column. Prospective cities will be marked with an asterisk and be in bold. The cities will be in the table in average rank order. The number 1 rank in each data set will be highlighted in green while the number 10 rank will be highlighted red.

Table 1: Rankings of the 10 cities for the social dimension

	Population	Population growth (% from 2016-21)	Population density (per square kilometer)	City rinks	CHL attendance	Average rank
Ottawa	4	2	9	1	6	4.4
Montreal	2	8	2	2	9	4.6
Edmonton	5	3	6	6	3	4.6
Calgary	3	6	5	7	4	5.0
Toronto	1	10	3	4	8	5.2
Quebec*	8	9	7	3	1	5.6
Halifax*	9	1	10	8	2	6.0
Vancouver	7	7	1	10	7	6.4
Saskatoon*	10	4	8	5	5	6.4
Winnipeg	6	5	4	9	10	6.8

It is evident that NHL cities compared to prospective cities do not hold a major social advantage, while the differences in population and density are significant, the hockey prevalence in the 3 potential cities is equivalent if not more important than current host cities.

Table 2: Rankings of the 10 cities for the environmental dimension

	Closest existing team flight time	Average climate	Average rank
Calgary	3	4	3.5
Edmonton	4	3	3.5
Ottawa	2	6	4.0
Saskatoon*	7	1	4.0
Montreal	1	8	4.5
Quebec*	5	5	5.0
Winnipeg	10	2	6.0
Toronto	6	9	7.5
Halifax*	9	7	8.0
Vancouver	8	10	9.0

In terms of proximity, if prospective cities were to gain a team, they would still be closer to current teams than other existing HUB cities such as Vancouver, although Halifax is not far behind. For climate, the prospective cities and current cities have similar climates, however, the larger cities prove to be warmer, which could be a consequence of the preexisting urbanization causing heat islands and microclimates. In sum, Saskatoon and Quebec have locations and climates that are advantageous for expansion, while Halifax seems to be far but with the advantage of being an untapped market.

Table 3: Rankings of the 10 cities for the economic dimension

	Average real estate price	Gross domestic product	Domestic tourism visit expenditure	Average rank
Toronto	2	1	1	1.3
Vancouver	1	3	3	2.3
Montreal	5	2	2	3.0
Ottawa	3	6	4	4.3
Calgary	4	4	6	4.7
Edmonton	8	5	5	6.0
Quebec*	9	7	7	7.7
Halifax*	6	9	9	8.0
Winnipeg	10	8	8	8.7
Saskatoon*	7	10	10	9.0

The economic dimension is where the division between current and prospective cities is evident. With the exception of Winnipeg, current HUB cities all have average rankings above 6.0, while potential cities are all below 7.7. Nevertheless, the economic growth from gaining an NHL team could account for the lack of present economic success.

Table 4: Rankings of the 10 cities for the infrastructural dimension

	Airport: Total passengers enplaned and deplaned	Public transportation: Percentage of population near public transit stop	Number of hotel rooms	Average rank
Toronto	1	1	1	1.0
Montreal	4	3	2	3.0
Vancouver	2	2	6	3.3
Calgary	3	4	5	4.0
Edmonton	5	8	4	5.7
Winnipeg	6	5	8	6.3
Ottawa	7	6	7	6.7
Quebec*	10	7	3	6.7
Halifax*	8	10	9	9.0
Saskatoon*	9	9	10	9.3

Infrastructurally, there also exist important distinctions between Saskatoon and Halifax compared to current cities. While Quebec has important transportation accessibility and accommodations, Saskatoon and Halifax are lacking in airport traffic, transportation and hotel rooms.

The differences in dimensions can be visualized in the radar diagram below:

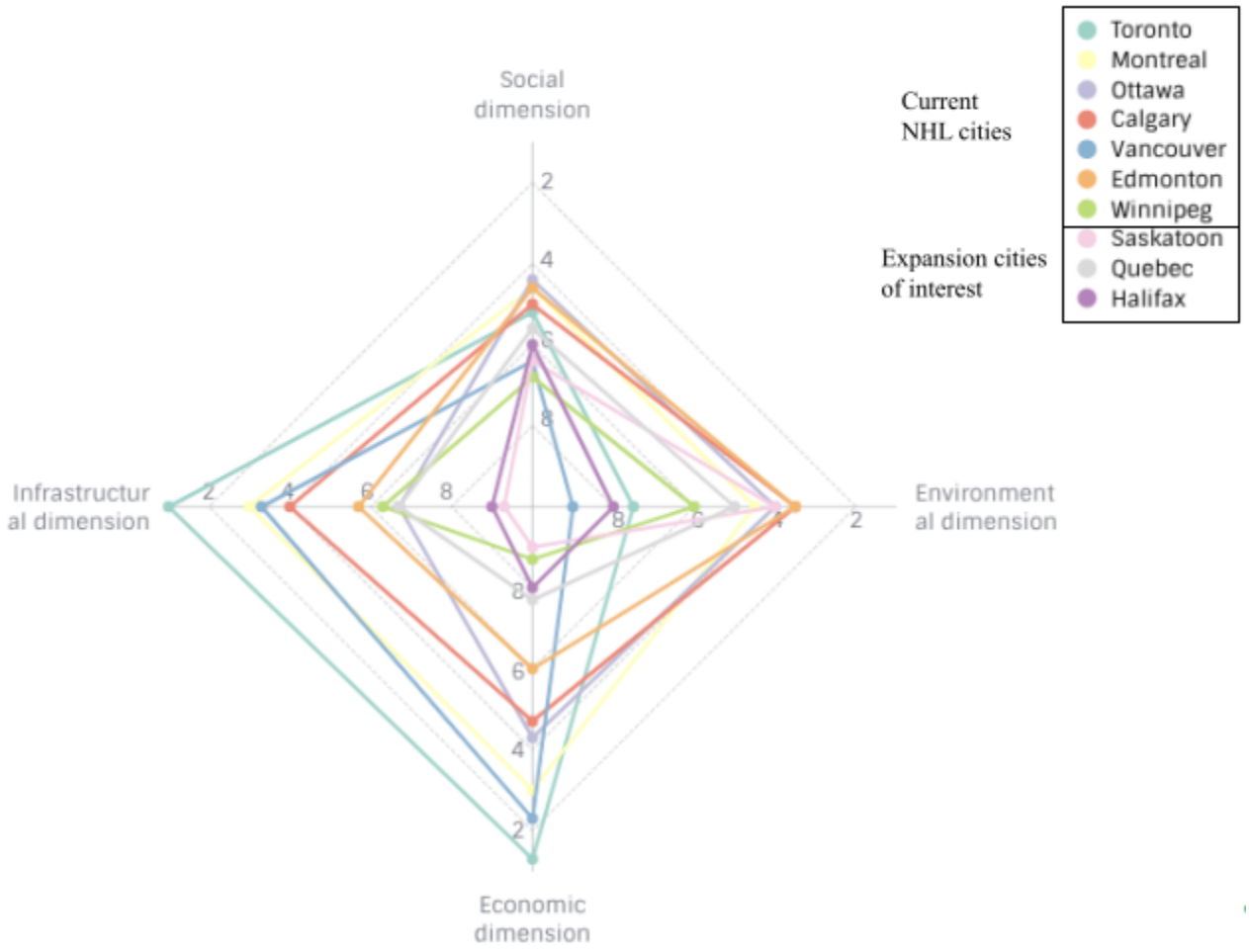

Figure 3. Radar diagram of average rank for each dimension of the cities analyzed

Created by Author using Vizzlo

The axes have been inverted in Figure 3 for visualization purposes so that the further out the point, the more potential is exhibited. Figure 3 shows that current NHL cities possess infrastructure and economic advantages over potential cities, while they are relatively similar in terms of environmental and social. Overall, Quebec is the only city that surpasses the current NHL HUB cities in 3 dimensions.

Table 5: Final average rankings

	Social ranking	Environmental ranking	Economic ranking	Infrastructural ranking	Final average rankings
Toronto	5.2	7.5	1.3	1.0	3.75
Montreal	4.6	4.5	3.0	3.0	3.78
Calgary	5.0	3.5	4.7	4.0	4.30
Ottawa	4.4	4.0	4.3	6.7	4.85
Edmonton	4.6	3.5	6.0	5.7	4.95
Vancouver	6.4	9.0	2.3	3.3	5.25
Quebec*	5.6	5.0	7.7	6.7	6.25
Winnipeg	6.8	6.0	8.7	6.3	6.95
Saskatoon*	6.4	4.0	9.0	9.3	7.18
Halifax*	6.0	8.0	8.0	9.0	7.75

The final average ranks can be visualized in the bar graph below. The axis has been inverted so that the size of the bar represents the relative geographic potential.

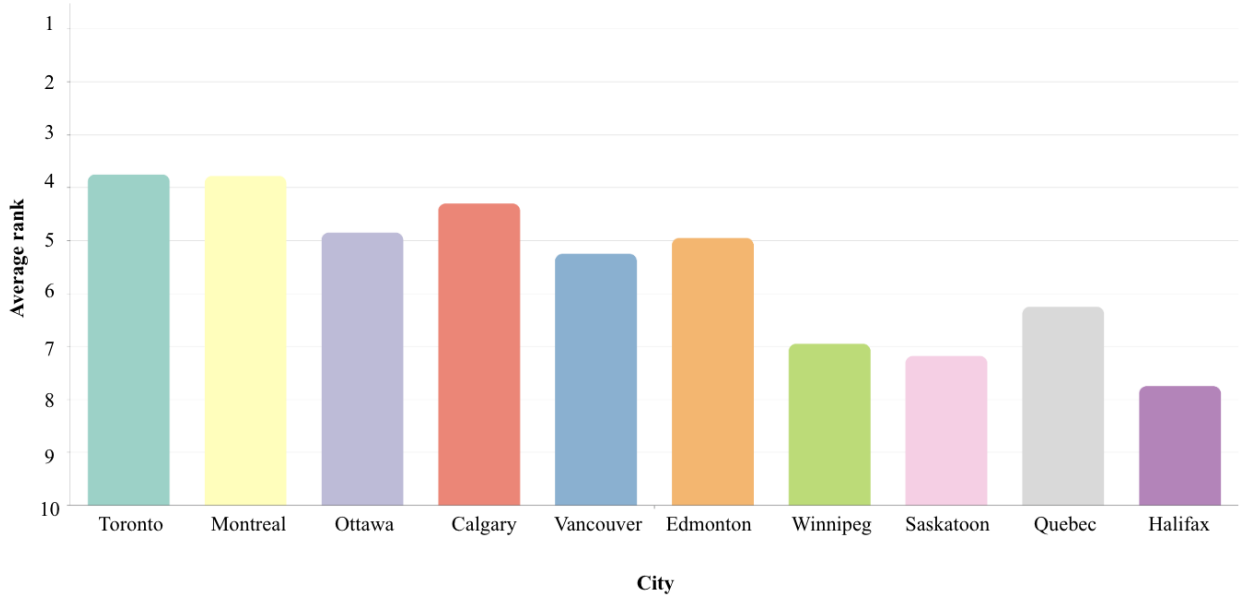

Figure 4. Bar graph of average rank of each city with an inverted axis

Created by Author using Visme and Google Drawings

There are evident differences in geographic characteristics suited for NHL expansion among current and potential cities, with a few exceptions. For potential cities, the average rank of Quebec is the highest among prospective cities at 6.25 and is above the current HUB city of Winnipeg. However, Halifax has the lowest rank followed by Saskatoon, which is still relatively close to Winnipeg. In sum, while the rankings of prospective cities are relatively low, they are not too distant from current HUB cities. The difference in rankings is in part due to the fact that they do not currently possess an NHL team, and growth in the upcoming years could bring these three cities closer to the geographical characteristics. Nevertheless, there is an understanding that expansion cities may not currently possess all the qualities that current HUB cities have, but present the potential to expand towards it. There is an evident tendency that current NHL teams rank higher than the potential cities with the exception of Winnipeg. Cities that ranked well economically tended to rank higher overall and the NHL focuses majorly on this aspect as it is a multi billion dollar market. The environmental factor, specifically climate, carries less consideration by the NHL as opposed to demographics, infrastructure and economy.

2.2 Analysis of cities

Central Place Theory

Central Place Theory is centered around the characteristics of settlements, or central places, including magnitude and spacing, which deliver services to nearby regions (Malczewski). Applying this theory allows for a ranking of possible expansion locations, in regards to their geographic potential and location from the rest of the league. The basic gravity model is often

employed with central place theory, indicating that the interaction between locations is equal to the product of their populations divided by the distance between squared. While this geographical model takes into account distance decay and centre magnitude, it is often limited, not accounting for political and economic factors (Horner). Therefore, this investigation will utilize central place theory through the lens of the gravity model while replacing population with (10-r), r being the average ranking from the method above.

$$I_{ab} = \frac{(10-r_a)(10-r_b)}{(d_{ab})^2}$$

Population will be replaced by 10-r as the rankings are from 1 to 10 with 1 presenting the highest potential. Thus, low numerical rankings which in reality reflect high potential will be converted to a larger number presenting a magnitude of potential. The unit for distance as these are cities will be in kilometers.

Saskatoon:

(a) Saskatoon

(b) Edmonton

$$I_{ab} = \frac{(10-r_a)(10-r_b)}{(d_{ab})^2} = \frac{(10-7.18)(10-4.95)}{(485.72)^2} = 6.03 \times 10^{-5}$$

Quebec City:

(a) Quebec City

(b) Montreal

$$I_{ab} = \frac{(10-r_a)(10-r_b)}{(d_{ab})^2} = \frac{(10-6.25)(10-3.78)}{(227.48)^2} = 4.51 \times 10^{-4}$$

Halifax:

(a) Halifax

(b) Montreal

$$I_{ab} = \frac{(10-r_a)(10-r_b)}{(d_{ab})^2} = \frac{(10-7.75)(10-3.78)}{(788.78)^2} = 2.25 \times 10^{-5}$$

The calculations above put into perspective the much stronger potential of interaction with Quebec City compared to Saskatoon and Halifax. Quebec City has the highest potential for expansion and shortest distance presenting an important opportunity for expansion, with a relative interaction of 4.51×10^{-4}. Saskatoon had a weaker potential for expansion and is also double the distance from the closest existing team, resulting in a relative interaction of 6.03×10^{-5}. While Halifax seems to be confronted potentially by a distance decay effect, with a relative interaction of 2.25×10^{-5}, it could represent an opportunity for the NHL to break into the Maritime market.

Saskatoon, Saskatchewan

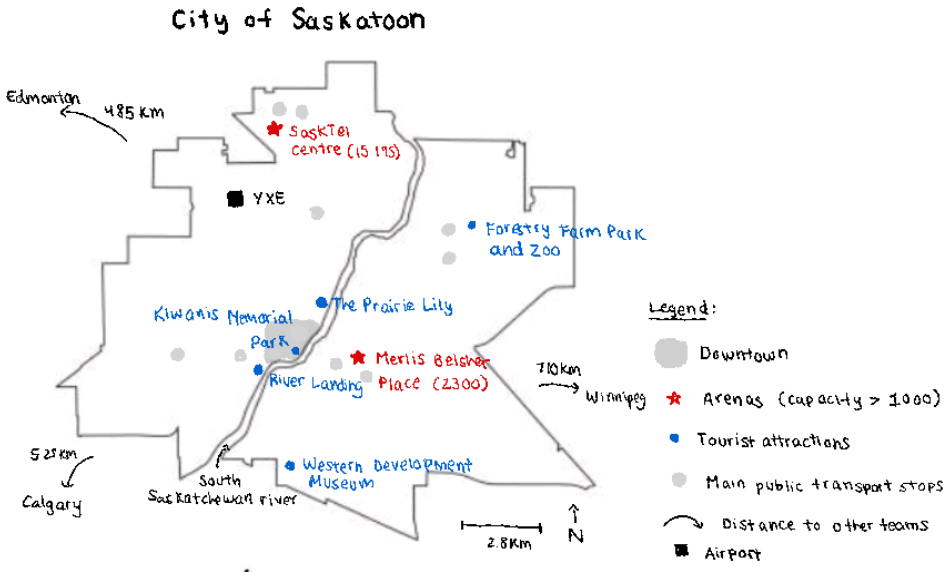

Figure 5. Urban plan of Saskatoon (Saskatchewan) with arenas, transportation, tourism and downtown

Created by Author, 2023

The quantitative evidence supporting Saskatoon as an expansion city is socially and environmentally, presenting an important gap in the Prairies that the NHL is missing. However, it

lacks infrastructurally and economically, which decreases its potential for expansion. When analyzing the urban plan of the city, either a new arena would need to be built or the SaskTel arena could be expanded.

Figure 6. Satellite image around SaskTel Centre in Saskatoon

Google. "Google Maps." *Google Maps*, Google, www.google.com/maps.

It is practically the same size as the Canada Life Centre, the smallest Canadian NHL arena, in Winnipeg. The arena is also much larger than the smallest NHL arena in Arizona, a struggling franchise, that has a capacity of only 4500 (Brockbank). While the SaskTel centre is found in the periphery of the Central Business district, it is still connected through main public transport stops and is close to the international airport.

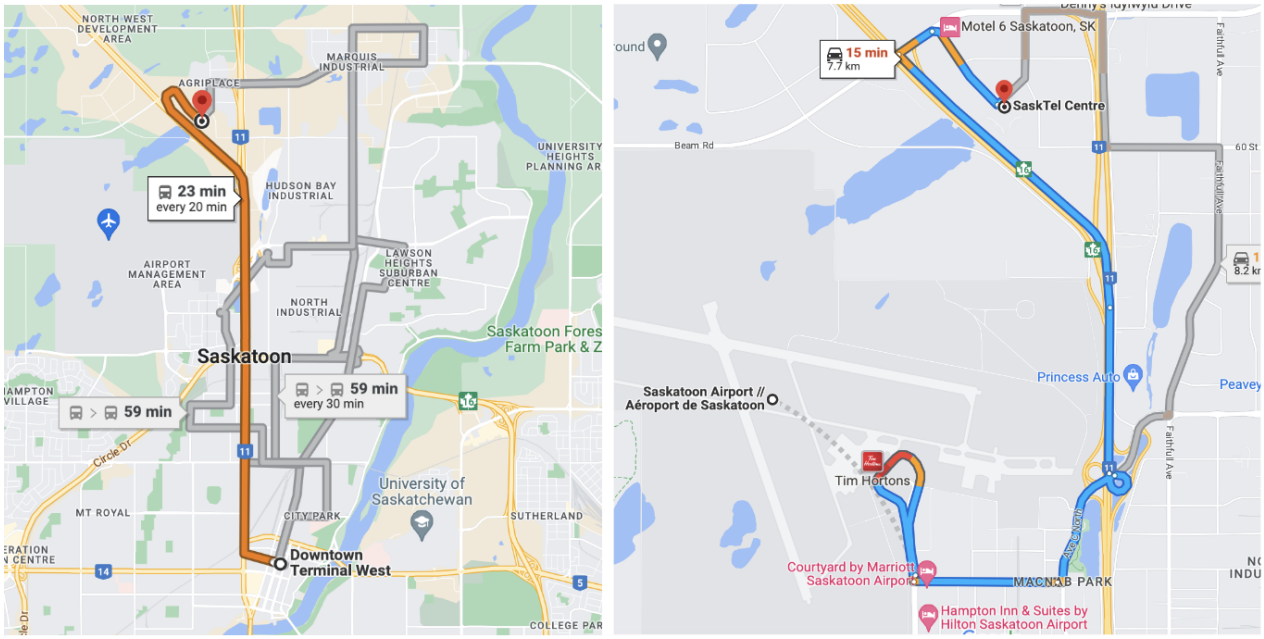

Figure 7. Google maps public transport time from Downtown Saskatoon to SaskTel Arena and driving time from Saskatoon Airport to SaskTel Arena

Google. "Google Maps." *Google Maps*, Google, September 7th 2023 at 5:30pm, www.google.com/maps.

Nevertheless, it is still far from the main tourist attractions of the city. However, it is found a short flight away from Edmonton, Calgary as well as Winnipeg.

Quebec City, Quebec

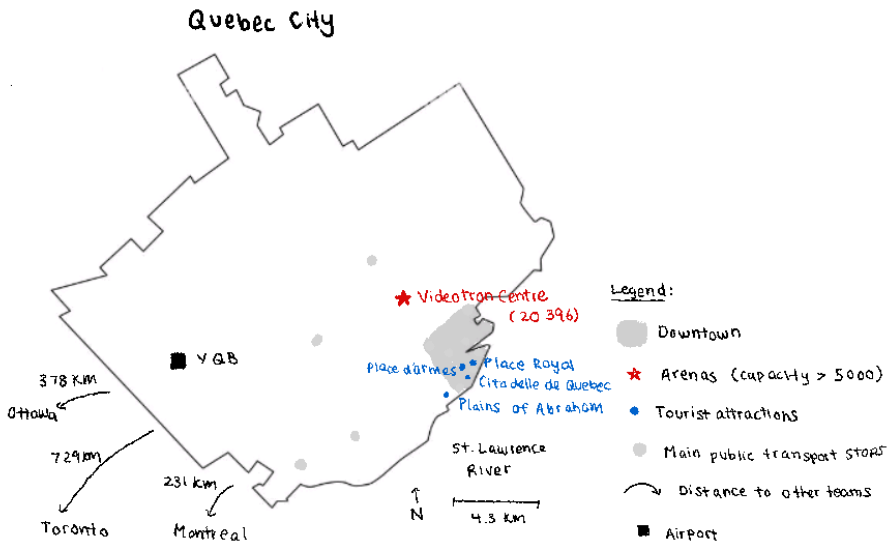

Figure 8. Urban plan of Quebec City (Quebec) with arenas, transportation, tourism and downtown

Created by Author

Quebec City has demonstrated the highest potential for expansion among prospective cities of interest, and an average rank above current NHL HUB city of Winnipeg. In terms of urban planning, the Videotron Centre has a capacity that can accommodate an NHL team and is close to the downtown region where the touristic attractions are located.

Figure 9. Satellite image around Videotron Centre in Quebec City

Google. "Google Maps." *Google Maps*, Google, www.google.com/maps.

On the contrary, a main public transport stop is not extremely close but is accessible by downtown transportation services. The airport, on the other side of the city, is still relatively close to the arena at just over 15 km away (Google). The location in terms of existing teams is a major advantage for this city, with Montreal and Ottawa being less than 400 km away and Toronto at 729 km away (Google).

Quebec City had an NHL team called the Quebec Nordiques that joined in 1979 and played a total of 16 NHL seasons before being relocated to Colorado (Parmele). This historic team can provide insight into expansion difficulties and opportunities today. Ultimately, the

reason behind the relocation was the lack of a modern arena and no plan to fix that issue (Storey). However, now Quebec has the Videotron centre which is up to NHL standards. In addition, during the Nordiques era, the exchange rate was very much in favor of the USD, impeding the economic success of the franchise and leading to its relocation. In this decade, Quebec has submitted an expansion request, but the hockey prevalent city was overlooked due to other Western American markets (Storey).

Halifax, Nova Scotia

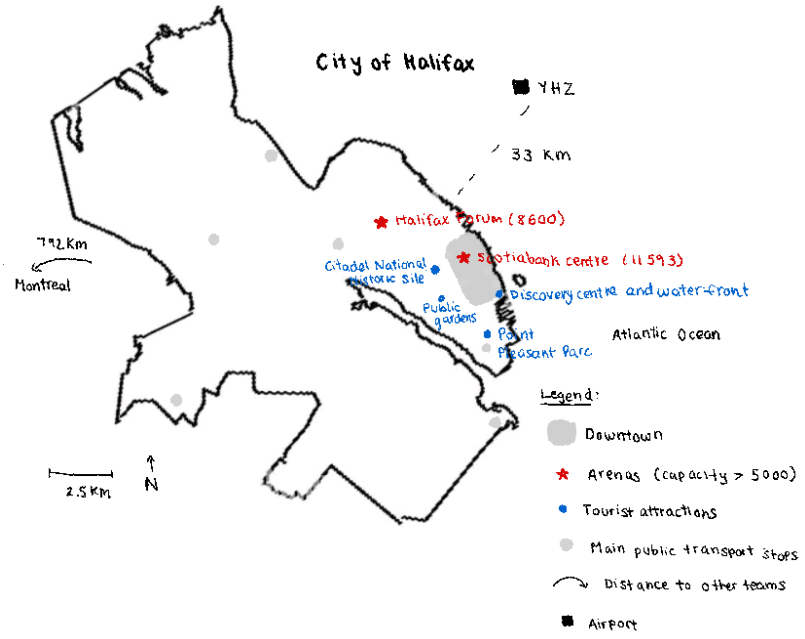

Figure 10. Urban plan of Halifax (Nova Scotia) with arenas, transportation, tourism and downtown

Created by Author

Halifax has the weakest potential for expansion of any prospective cities, only presenting a strong social dimension. Nevertheless, the urban plan is an advantage for Halifax. The Scotiabank centre with a capacity just shy of the smallest Canadian NHL arena and could host an NHL team if expansion were to occur, provided a few upgrades in capacity. The location of the

Scotiabank Centre is central downtown and in proximity to tourist attractions, possibly attracting more fans to visit.

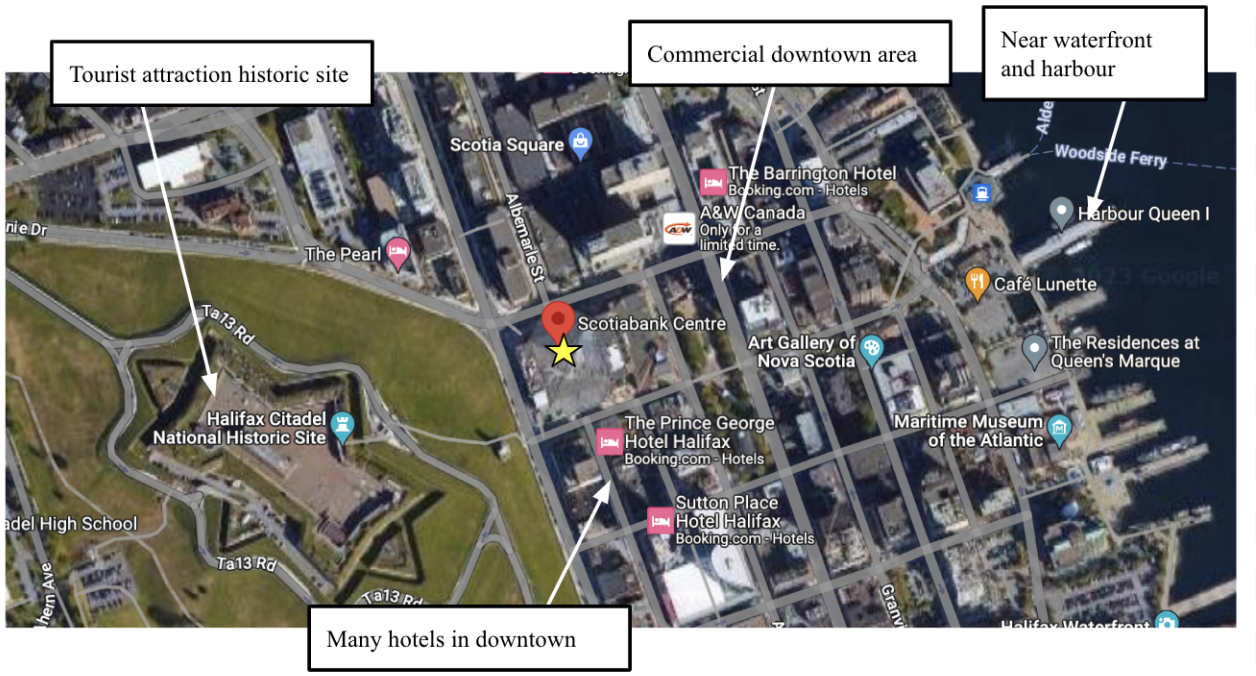

Figure 11. Satellite image around Scotiabank Arena in Halifax

Google. "Google Maps." *Google Maps*, Google, www.google.com/maps.

This downtown is supported by many public transportation services, allowing easy access for fans to arrive. However, the distance from the airport could present a disadvantage for the city as well as the proximity to other teams. With Montreal being the closest city, 792 km away, this can be viewed as either an opportunity to break into the Maritimes market or an obstacle for this hockey prevalent city to obtain an NHL team.

3. Conclusion

To conclude, the cities of investigation, Saskatoon, Quebec City and Halifax, each present specific potential for NHL expansion. While all cities lacked economically, Quebec has presented the greatest potential for expansion with strong social and environmental potential. Quebec has an arena up to NHL standards in an ideal location, an important hockey culture and proximity to current NHL teams. Nevertheless, the relocation of the Nordiques provides some hesitation as to if Quebec can regain an NHL team and support them economically with a small population. In addition, the proximity to existing markets could deter the NHL from expanding, as there are already multiple NHL teams in the region. Overall, Quebec was the only prospective city with an average rank above that of a city with an NHL team. Second in potential was Saskatoon, also having a strong social and environmental potential. With no NHL teams in Saskatchewan, this city would present a new market for the NHL. Even while having a small population, the growth could be something to focus on in the upcoming years. On the contrary, the lack of infrastructural and economic strength is a great disadvantage for expansion, limiting its potential. Finally, is Halifax, a hockey central city, with the second highest CHL attendance among NHL and prospective cities and an NHL caliber arena in a prime location. Although the distance from existing teams and lack of public transportation in general is a great disadvantage, it could be viewed as an opportunity to enter the Maritimes. In summary, Quebec City demonstrates the most potential for expansion with a rank higher than Winnipeg, an existing HUB city, but still needs to improve economically to be a stronger candidate. This ultimately supports my initial hypothesis while pinpointing specific areas in which each city is lacking. Overall, final rankings were most similar to the economic dimension. Ultimately, the NHL prioritises economic success over environment or demographics.

Evaluation

This investigation has focused solely on the geographic potential, as it is essential as a first step for consideration in expansion. However, it must be noted that the NHL is for profit and relies heavily on the economics of the city, such as investors and market size, to analyze its potential, which has not been thoroughly explored in this investigation. In addition, Winnipeg was an anomaly, being ranked lower than Quebec City, a prospective city. Winnipeg placed last in CHL attendance, closest flight to an existing team and average real estate price. The success of this city, after its relocation in 2011, could be attributed to the raging hockey culture.

The method of investigation employed presented a holistic view of the cities. However, the data sets were not consistent from a single source, as municipal data is not often kept at a national level. In addition, the investigation has focused solely on Canada, but it should not be ignored that the United States also plays a major role in the league and that expansion could take place there. Finally, geographic prospective analysis using current data to evaluate situations and changes in the future could alter the geographic potential of the cities investigated.

To summarize, certain Canadian cities present an important geographical potential for expansion, superior to even a preexisting NHL hub. Nevertheless, the economy seems to be at the forefront of the league and many Canadian cities would need to develop further to attain the smart power of current NHL Hub cities such as Toronto or Montreal.

4. Appendix

Appendix A: Population and demographics data (a)

	Population	Population growth (% from 2016-21)	Population density (per square kilometer)
Toronto	2,794,356	2.3	4,427.8
Montreal	1,762,949	3.4	4,833.5
Ottawa	1,017,449	8.9	364.9
Calgary	1,306,784	5.5	1,592.4
Vancouver	662,248	4.9	5,749.9
Edmonton	1,010,899	8.3	1,320.4
Winnipeg	749,607	6.3	461.78
Saskatoon	266,141	7.7	1,174.7
Quebec	549,459	3.3	1,214.8
Halifax	439,819	9.1	80.3

(a) www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E.

Appendix B: Hockey prevalence data

	City rinks	CHL attendance	
Toronto	99 (a)	Mississauga Steelheads	2038 (k)
Montreal	225 (b)	Blainville-Boisbriand Armada	1696 (l)
Ottawa	262 (c)	Ottawa 67s	4282 (m)
Calgary	19 (d)	Calgary Hitmen	4874 (n)
Vancouver	8 (e)	Vancouver Giants	3462 (o)
Edmonton	31 (f)	Edmonton Oil Kings	6412 (p)
Winnipeg	12 (g)	Winnipeg Ice	1649 (q)
Saskatoon	58 (h)	Saskatoon Blades	4506 (r)
Quebec	108 (i)	Quebec Remparts	9726 (s)
Halifax	14 (j)	Halifax Mooseheads	7642 (t)

(a) www.toronto.ca/data/parks/prd/facilities/indoor-rinks/index.html
www.toronto.ca/explore-enjoy/recreation/skating-winter-sports/public-leisure-skating/#location=&lat=&lng=

(b) montreal.ca/en/articles/where-to-skate-montreals-best-rinks-3299#:~:text=Did%20you%20know%20that%20Montr%C3%A9al,to%20skate%20in%20the%20city.

(c) ottawa.ca/en/recreation-and-culture/recreation-facilities/parks-and-green-space/outdoor-rinks#section-cff034af-cc61-48f1-befd-daa628e2b318

(d) www.calgary.ca/rec-locations/arenas.html

(e) vancouver.ca/parks-recreation-culture/ice-rinks.aspx

(f) www.edmonton.ca/activities_parks_recreation/outdoor-ice-rinks
www.edmonton.ca/activities_parks_recreation/arenas

(g) legacy.winnipeg.ca/cms/recreation/facilities/arenas/arenas.stm

(h) www.saskatoon.ca/parks-recreation-attractions/recreational-facilities-sport-fields/skating-rinks

(i) www.ville.quebec.qc.ca/citoyens/loisirs_sports/installations_sportives/patinoires_exterieures/patinoires_exterieures.aspx
www.ville.quebec.qc.ca/citoyens/loisirs_sports/installations_sportives/patinoires_interieures/patinoires_interieures.aspx

(j) www.halifax.ca/parks-recreation/facility-rentals-bookings-field-conditions/bookings-rentals/arenas

(k) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=11038

(l) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=10721

(m) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=7314

(n) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=5091

(o) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=8759

(p) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=5630

(q) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=12613

(r) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=7897

(s) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=9451

(t) www.hockeydb.com/nhl-attendance/att_graph.php?tmi=5976

Appendix C: Proximity to other teams data (a)

	Closest existing team direct flight time (hours:minutes)
Toronto	1:03
Montreal	0:43
Ottawa	0:45
Calgary	0:50
Vancouver	1:22
Edmonton	0:52
Winnipeg	2:05
Saskatoon	1:15
Quebec	0:59
Halifax	1:40

(a) www.aircanada.com/ca/en/aco/home.html

Appendix D: Climate data (a)

	SSP2-4.5 Median temperature (2011-2040) in Celcius
Toronto	10.1
Montreal	8.5
Ottawa	7.8
Calgary	5.4
Vancouver	11.6
Edmonton	4.6
Winnipeg	4.5
Saskatoon	4.2
Quebec	6.6
Halifax	8.4

(a) www.climatedata.ca/explore/location/?loc=FEUZB&location-select-temperature=tg_mean&location-select-precipitation=r1mm&location-select-other=frost_days

Appendix E: Cost of land data

	Average real estate price (CAD$)
Toronto	1 118 500
Montreal	511 500
Ottawa	622 300
Calgary	528 700
Vancouver	1 143 900
Edmonton	371 200
Winnipeg	336 300
Saskatoon	376 300
Quebec	362 490*
Halifax	496 900

All data is derived from the following site, www.crea.ca/housing-market-stats/canadian-housing-market-stats/national-price-map/, with the exception of the data with an asterisk (*) which was derived from www.canadianrealestatemagazine.ca/expert-advice/canadian-average-home-prices-by-city-compared-334894.aspx

Appendix F: Gross domestic product data (a)

	Gross domestic product (CAD$ x 1 000 000)
Toronto	442,180
Montreal	233,996
Ottawa	73,878
Calgary	111,259
Vancouver	163,475
Edmonton	91,568
Winnipeg	46,301
Saskatoon	20,691
Quebec	48,544
Halifax	24,098

(a) www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610046801.

Appendix G: Tourism data (a)

	Domestic tourism visit expenditures (CAD $ x 1000)
Toronto	5 495 092
Montreal	3 245 288
Ottawa	1 974 089
Calgary	1 766 481
Vancouver	2 557 220
Edmonton	1 937 159
Winnipeg	844 329
Saskatoon	510 525
Quebec	1 491 408
Halifax	718 148

(a) www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2410003001&pickMembers%5B0%5D=1.14&cubeTimeFrame.startYear=2014&cubeTimeFrame.endYear=2017&referencePeriods=20140101%2C20170101

Appendix H: Transportation data

	Airport: Total passengers enplaned and deplaned (a)	Public transportation: Percentage of population near public transit stop (b)
Toronto	12,368,926	93.0
Montreal	4,976,961	91.6
Ottawa	1,122,306	85.0
Calgary	5,909,265	88.9
Vancouver	7,003,245	92.7
Edmonton	2,593,046	82.7
Winnipeg	1,164,252	88.2
Saskatoon	428,800	82.6
Quebec	313,860	83.1
Halifax	1,048,821	70.9

(a) www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310025301.

(b) www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310028601.

Appendix I: Accomodations data

	Hotel rooms
Toronto	36 000 (a)
Montreal	25 000 (b)
Ottawa	11 000 (c)
Calgary	15 470 (d)
Vancouver	13 290 (e)
Edmonton	16 956 (f)
Winnipeg	7 600 (g)
Saskatoon	4 500 (h)
Quebec	17 000 (i)
Halifax	5 887 (j)

(a) www.gtha.com/about-gtha#:~:text=Our%20Members,guest%20rooms%20and%2032%2C000%20employees.

(b) www.mtl.org/en/Accommodations

(c) ottawatourism.ca/en/connect-ottawa/new-ottawa-hotels-enlarge-business-accommodation-offerings

(d) www.cbc.ca/news/canada/calgary/calgary-hotel-occupany-tourism-economy-1.5241953

(e) vancouversun.com/news/local-news/20000-new-hotel-rooms-needed-metro-vancouver-2050-destination-vancouver#:~:text=As%20of%202022%2C%20Vancouver%20had,10%2C000%20rooms%2C%20said%20the%20report.

(f) www.ahla.ca/wp-content/uploads/2017/09/Edmonton-AB.pdf

(g) www.meetingswinnipeg.com/plan-your-meeting/convention-hotels

(h) www.tourismsaskatoon.com/meetings/why-saskatoon/

(i) meetings.quebec-cite.com/en/plan-meeting-quebec-city/event-accommodation-quebec-city

(j) halifaxpartnership.com/research-strategy/halifax-index-2020/trade-tourism/

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