

Is there a demand in the future for Micro-Housing in Canada?

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ABSTRACT

This paper evaluates micro housing as a potential solution to easing the demand for housing in Canada. The research approach primarily includes a literature review to answer questions related to: demand, potential consumers, and market sustainability. The research methodology embeds statistics focussing on the current housing market in Canada at the macro-level and specifically for two major Canadian cities (Toronto and Vancouver) at the micro-level. Assessing the population statistics of these two cities in combination with the key benefits and challenges for the adoption of micro housing provided further insight into the status of the housing market at the provincial and national levels. This information was then used to evaluate and project future shifts in the population to inform the primary and secondary research questions concerning the demand.

The rising cost of housing was found to be a critical factor in influencing consumers to demand smaller living quarters, satisfying the emerging cultural shift toward minimalism and the affordability quotient. This shift is apparent in the increasing popularity of tiny house television shows, and do-it-yourself house building projects promoted in the media across the country. With this engaged interest level of consumers looking for alternative housing options, a new niche in the housing development industry has emerged. Although only a niche in present day, when assessing the potential for the implementation of micro housing through projections 30 years in the future, it is likely to be more a common building structure than a novelty item.

The research findings suggest that the high consumer demand for alternative housing options will be a key influencer in the housing market as the population grows. By identifying the specific types of housing in short supply and the future housing demand, the urgency for changes in policy at both the provincial and national level for building and livability standards was revealed. Furthermore, the development of new lending policies by financial institutions was identified as a gap to be closed for the successful adoption of micro housing home ownership. To conclude, the research questions are answered and recommendations are provided to a start-up micro house development company. These recommendations are intended to establish the use of operational and risk frameworks thus ensuring that the assessment potential and risk mitigation strategies form their foundations in success.

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1. INTRODUCTION

Housing in Canada has now reached crisis levels and needs to be addressed. From the fast-rising real estate prices and the lack of rental vacancies, to the influx of foreign buyers (Jang, 2017), Canada is struggling to meet the needs of its citizens. Specifically, this is evident in metropolitan areas such as Toronto, ON and Vancouver, BC. These two Canadian metropolitan cities are showing the strain to meet the demands of the residents' (Ligaya, 2017). People seeking to purchase a home in Toronto or Vancouver find the price of purchasing a home unavailable to them. Additionally, the rental market is at an all-time low given that landlords want to capitalize on the real estate market 'boom', thus impacting both the demand for housing available to purchase and to rent (Ligaya, 2017). For example, the statistics in BC's capital city of Victoria highlight a vacancy rate of only 0.5% (Thomas, 2016) suggesting this city is also being impacted by the low level of sufficient and affordable housing.

The media has publicized varying viewpoints surrounding Canada's housing bubbles yet no viable solutions have taken root. This has left Canadian's with an immediate need to find a solution to the growing housing demand. One alternative solution is 'micro housing'. The alternative solution plus other housing concepts has created a niche market. This niche market of individual house builders and development companies (Quigley, 2016) reviewed in this research paper aims to establish how these solutions address sustainability in meeting the supply and demand by targeting identified consumers seeking alternative solutions to affordable housing.

For example, *Living Tiny Developments Ltd.* (2016) is one such development company, whose strategic focus is to provide affordable housing options using micro housing as an alternative to achieve a healthier way of life for years to come. This research paper aims to address the question of whether these builders and development companies providing micro housing is a sustainable option to addressing future demand.

There are several barriers shown to impact companies accessing the entry of this market. These barriers include: national, provincial and local building codes, by-law regulations and density restrictions (Porter, 1979, Micro Showcase, 2015). These factors increase the complexity as Canadian standards are provincially legislated and some have imposed housing size and density restrictions (i.e. the number of houses which can be built on certain parcels of land (City of Victoria, 2017).

The factor of housing density restrictions is addressed in the Market Sustainability section of this paper. Additionally, the political support required for change, including the social, economic, environmental and technological factors shown to impact demand and sustainability. An assessment is provided for the risks and benefits of living in micro housing and in communities of small footprint homes. A description and

explanation of the contingency plans require to mitigate the risks identified in this section is further explored.

The concluding section presents an analysis of the findings which inform the research questions and the evidence to make recommendations for development companies (i.e. Living Tiny Developments) to consider in the development of their future business case.

These recommendations are aimed at enhancing the success of companies such as Living Tiny Developments, by using predictive analytics to project future demand information, to inform their strategy of building micro housing and to relieve the shortage in Canadian housing supply both now and in the future.

2. RESEARCH PURPOSE AND RESEARCH QUESTIONS

The purpose of this research is to answer the question, “*Is there a demand for micro housing in Canada in the future?*”

The term *demand* is defined in the economics literature, as the relationship between goods and services and corresponding prices (Maurice, 2013). This definition has been adapted for this research paper to include the relationship between the housing required by the population and its size and price.

The term *micro housing* is defined explicitly by its size of 100 to 400 square feet of living space (Kilman, 2016). Additionally, it is also associated with the term cost effectiveness (Aston, 2015).

These terms including the term future are used throughout this paper to highlight the focus of this research and are described in detail in the Glossary of Terms appended to the end of this document.

2.1 RESEARCH PURPOSE

The Canadian housing landscape has changed during the past 50 years in size, price and demand. What was previously stated as the average size home in 1950, is about one-third the average size of a home in 2017 (Gottberg, 2016; Pitts, 2004) highlighting how size has impacted the market. Combined with size are the associated demands of the current growth in population. These two factors combined with the increase in generational shifts have led to a complex scenario for housing. Large generational shifts in the demographic population, cultural shifts and trends relating to minimalism through simpler living and future sustainability are also key considerations. With fewer first time homebuyers entering the market due to lack of affordability (Miron, 1984), and the aging population no longer interested in or capable of maintaining their established homes (Aston, 2015), a gap in housing needs has developed. How Canada can

address this gap in housing needs using alternative solutions is what has prompted this research. Specifically, this research explores the applicability of micro housing, its future demand based on population demographics, and its sustainability.

At the outset, the initial literature review, sub-questions surfaced specific to the applicability of micro housing in Canada and its sustainability. These sub-questions are identified as:

- *How will it fill the gap in the housing market?*
- *How will it be sustained?*

This research has used a generic assessment of a small start-up micro housing development company, Living Tiny Developments Ltd. The information related to this company is public, and has been used solely for the purposes of evaluating viable options for addressing the issues raised in this paper as they relate to micro housing, future demand and sustainability. Initially, the research questions were focused on answering the question of micro housing and whether or not this type of housing was seen as a trend, fad, short-term fix, or a long-term solution. This promoted a focus of seeking answers to the applicability to the current and future Canadian market. Thus, the following sub-questions were developed:

- *What is the demand?*
- *Where is the demand?*

The initial search of the literature highlighted that other global cities have successfully employed micro housing. These markets have been identified and included in this research to show the comparison and the differences with the Canadian market and to assess the applicability for their integration. This highlighted the need to address the following sub-questions:

- *Who will purchase micro housing?*
- *How will population changes affect the demand?*

The exploration of the sub-questions informs the primary research question, drawing connections between each focus area and the impact they have on the success of future demand for micro housing in Canada.

2.2 SCOPE & ASSUMPTIONS

This paper first identifies the housing crisis in Canada at a macro level, and then narrows its focus to the micro level for two of Canada's largest metropolitan cities: (1) Vancouver, BC, and (2) Toronto, ON. Both of these provinces were evaluated using

population statistics, including the real estate prices and rental vacancy rates to establish the current status of the respective markets in, 2017.

Secondly, computer modelling software was used to predict the population forecast and shifts using both BC and Ontario statistics. The innovative approach to predicting future demand for alternative housing solutions embeds the required evidence into the findings to enable viable solutions to meeting future population growth.

Out of scope for this research is the delineation of consumers by ethnic group, financial income bracket, rural vs. urban development, current housing status (i.e. low-income or subsidized) and native born or immigrant status. The literature has highlighted the Canadian Indigenous population as a population having significant growth in the future; this targeted group is considered outside the scope of this research.

Assumptions regarding the Canadian population that are made throughout the research paper include:

- the continued desire to purchase real estate in the future
- the financial ability to make real estate purchases that meet affordability standards (see glossary of terms for definition of affordability), and
- that housing can be developed to meet the population demand

Further, it is assumed that developers will be willing to evolve with new standards to create alternative housing options and that governments will revisit regulations that may impede the building of these alternate solutions.

2.3 RESEARCH QUESTIONS

The research questions that guided this research were:

1. Is there a demand for micro housing in Canada in the future?
2. What is the demand?
3. Where is the demand?
4. Who will purchase micro housing?
5. How will population changes affect the demand?
6. How could micro housing fill the gap in the housing market?
7. Is micro housing sustainable?

3. LITERATURE REVIEW

Multiple sources of literature have been reviewed to evaluate and respond to the primary research question of *whether there is a demand for micro housing in Canada in the future*. Sources reviewed informed the research design for the literature approach

to complete this research study. From the literature reviewed, several factors have been shown to impact demand that produced sub-questions. These sub-questions provided the research framework in three areas:

1. Demand
 - a. Where is the demand?
 - b. What is the demand?
2. Consumers
 - a. Who will purchase micro-housing?
 - b. How will population changes affect demand?
3. Sustainability
 - a. How will micro housing fill the gap in the housing market?
 - b. How will it be sustained?

Before expanding into these areas, it is necessary to revisit the terms previously stated (see Introduction). The definition being used for the purposes of this research has defined micro housing by its footprint of living space with the most consistent focus on defining the size to fall within 100 to 400 square feet (Kilman, 2016; Zeiger, 2011; Living Tiny Developments Ltd., 2016; Micro Showcase, 2015). Additionally, Kilman (2016) suggests that the customizable styles of footings; either on a flat deck trailer bed (wheeled bases) or poured foundation must also be included when defining micro housing.

3.1 THE DEMAND

As previously stated, three areas of focus inform the primary research question, 'Is there a demand for micro housing in Canada in the future?' Specifically, each theme is inter-related creating the need for a deeper dive into the research. . In this section, the sub-questions related to 'What is the demand?' and 'Where is the demand?' are explored. Statistics sourced from government censuses and real estate boards contribute to the evidence highlighting the national, provincial and local perspectives of demand of the two major metropolitan cities studied (i.e. Vancouver, BC and Toronto, ON).

3.1.1 WHAT IS THE DEMAND?

It was previously stated that demand is defined as the need for housing for the population as it ages, which is affordable and sufficient in size and location (see Glossary of Terms).

The literature suggests that demand lies in the consumer driven need for smaller sized homes and the desire to downsize (Frumkin et al, 2004; Caravaca Gallardo, 2013; Gottberg, 2016; Pitts, 2004; Gravel, 2016). The authors further suggest that smaller

footprint developments are necessary owing to the reduction in the availability of land in the future, thus giving the general population no other option but to seek alternative development solutions (Frumkin et al, 2004; Pitts, 2004; Kaiser et al., 1995). This combined with the additional considerations, such as affordability (Miron, 1984) and the supply of liveable spaces due to the population changes, are also key contributors shown to impact demand (Eichholtz & Lindenthal, 2014).

The review of the literature suggests that housing size has seen a three-fold increase compared to that available in 1950 (Gottberg, 2016; Pitts, 2004). Gottberg (2016) stated, the increase in housing size, has driven a significant growth in consumer accumulation of furnishings and other personal effects, which is now being recognized as unmanageable and unsustainable thus creating the demand for downsizing.

The authors also suggest that this explosion in society of 'the need for more' is associated with success. Measuring success with materialistic goods such as the size of an individual's house is a double edge sword. It has created a form of economic prison for individuals owing these homes (Gauer, 2004; Zeiger, 2011). Quigley (2016) also suggests that this antiquated desire in the over consumption of material possessions has changed in favor of a lifestyle filled with more authentic experiences. Several others were shown to support Quigley's statement. These authors suggest a shift has begun across North America. This shift in culture rejects overconsumption and "McMansions" through new and future trends of minimalism and ways of living with less (Zeiger, 2011; Kippist, 2013; Living Tiny Developments, 2016).

The evidence to support the trend of minimizing and living with less is addressed by a significant number of authors. For example, Caravaca Gallardo (2013) quotes Mies Van der Rohe, a noted German/American architect and designer, who died in 1969, who supported the philosophy of "less is more" and encouraged the demand for downsizing to smaller housing, and others (e.g. Zeiger, 2011; Gravel, 2016; Pitts, 2004; Gauer, 2004) are shown to support the concept of living in micro houses using sustainable architecture would offer people the ability to live richer lives.

Moreover, the literature highlighted that practicality is heightened through more inventive uses of interior space aimed at implementing micro homes and their design (Zeiger, 2011). Whereas, Gauer (2004) concurs that small homes are "more convenient, less expensive and less wasteful of scarce resources". Other benefits of owning a micro dwelling included lower costs for heating and water, lower mortgage payments and smaller property taxes (Smarter Growth Initiative, 2016). Posadzki (2015) suggests that micro housing saves time and requires less maintenance both in effort and expense. Leblanc (2016) adds another benefit of micro dwellings as the ability to adapt your living space to your lifestyle. Thus, this form of housing (e.g. micro

apartments and micro homes) has emerged as a beneficial solution to the housing crisis (Morris, 2016).

With the increase in the average house size, the amount of available land to build housing has been significantly reduced (Zeiger, 2011). This has caused a shift in the sprawl of housing to move beyond urban centres (Frumkin, Frank, & Jackson, 2004). An option for cities to consider is micro apartment buildings which the literature suggests can help to resolve issues surrounding the lack of supply (Dawid, 2014; Cater, 2015, Gravel, 2016).

The review of the literature, highlighted authors who suggest there is a need to build micro apartments in the city in combination with smaller footprint housing on the surrounding perimeter to maximize the remaining land space and minimize transportation needs (Frumkin, Frank, & Jackson, 2004).

These innovative approaches are supported by Caravaca Gallardo (2013) who suggests that a denser city is more sustainable and efficient than those subject to urban sprawl.

Directly connected to the supply of housing is its affordability which Miron (1984) defines as corresponding to what is 'normal' for the specified community. For the purposes of this research, the definition of *affordability* is where home owners are restricted to paying no more than 30% of their total household income on shelter expenses (Statistics Canada, 2016). *Affordability* has become scarce due to the limited availability of housing driving real estate prices to an unrealistic standard thereby creating the demand for alternative solutions (Jang, 2017). Lefebvre (2002) suggests that housing price is tied to location and income.

The housing prices Vancouver, BC during the past five years (2012 – 2017) are shown to have increased by 59.99% and in Toronto, Ontario by 75.81% (The Canadian Real Estate Association, n.d.). An additional factor reducing the availability of housing specific to Vancouver, BC, is the influx of foreign buyers whose purchases have increased "more than two-hundred-fold" between 2008 and 2014 (Sun, 2015). Foreign buyers in Canada are out of scope for this research. However, the impact of foreign buyers on the Canadian housing market is important to note.

Another impact to *housing demand* is suggested to be the increase in the immigrant population, potentially pointing to immigration as being responsible for the increase in housing demand (Marr, 2016). Statistics from the Canadian census suggest that growth rates in the Indigenous population (45% growth of Indigenous vs. 8% rest of the Canadian population) as well as the senior population (those aged 65 and older are expected to increase doubling for the first time in Canada the number of seniors versus that of children under 15 years of age). These two groups are shown to impact the demand for housing in Canada (Government of Canada, 2008).

Magnus (2009) suggests that the increase in the senior population must be seriously considered while accessing the demand for housing. As previously stated, the demand created by immigration and the Indigenous Peoples are outside the scope of this research study. The demand for housing for this study has not taken the factors of race or on-reserve living into consideration. However, this research has considered both the existing and future population age bands to illustrate the impacts of population changes and to identify potential consumers of micro housing in section “3.2 Potential Consumers”.

3.1.2 WHERE IS THE DEMAND?

The next focus is on determining where the demand for micro housing exists in Canada. The literature suggests that housing in Canada has reached crisis levels (Tory & Iveson, 2016) in two of its largest metropolitan cities, Vancouver, BC and Toronto, ON. The literature suggests these two metropolitan areas have priced themselves out of the affordable housing market for the majority of Canadian consumers. (Leblanc, 2016; Bellet, 2015). Friedman (2016) suggests that in the wake of the 2008 financial crisis, many home buyers are unable to accumulate the savings necessary to purchase a home currently in these two markets. There is however, a strong demand for micro units in these metropolitan centres to provide affordable and efficient housing near transportation and other amenities (Press, 2015; Bellet, 2015, Leblanc, 2016). Press (2015) suggests that the Toronto, ON market has a strong demand for “shoe-box condos,” (his specific name for micro apartments) with Bellet (2015) echoing similar sentiments for the Vancouver, BC market. Bellet (2015) notes that the first micro lofts (yet another name for micro apartments) built as rental units in Vancouver in 2009 have been a success, yet still government policies and regulations will not allow a condo to be sold that is less than 398 square feet in size.

The literature suggests that first time home buyers are shifting away from buying detached homes in general (regardless of size) in favour of apartments and smaller dwellings due to these conditions in the real estate market (Friedman, 2016). Authors suggest that the younger generation value personal and family time, and are trading off owning a large piece of property or home, to have more time for entertainment and amenities (Bellet, 2015; Smarter Growth Initiative, 2016). Studies on persons retired and/or those approaching retirement have also suggested this population group is seeking to leverage their income by moving into smaller quarters thus reducing their overall housing expenses. (Aston, Downsizing: Go Small, Think Big, 2015). However, the review of the literature on Canadian Mortgages (Canadian Mortgages Inc. 2012) suggest that not all of the aging population shown an interest in downsizing. For the purposes of this research, the findings from the review of this literature, connects the demand sub-questions of ‘where is the demand?’, and ‘how will population changes affect the demand?’ by emphasizing the impact the differences in the generations of consumers has on future demand.

To establish a thorough review of micro housing, the opposing view against its development must also be discussed. Bellet (2015) suggests that micro housing is not the only solution to the evolving housing crisis, and states there are concerns about livability, affordability and sustainability. Suitable housing as defined by the National Occupancy Standards state that a dwelling must align with the composition of the resident household and have the corresponding number of bedrooms. This definition was often shown to be included in the literature on micro housing (Gaetz, Scott, & Gulliver, 2013).

Furthermore, Lobo (2014) suggests that micro housing has value of approximately ten-years for the younger generation owing to the decision of having a family and the need for additional space. These factors may impact sustainability. Other factors shown to impact the decision to purchase micro housing include the need for space to have large family gatherings, if the individual is an avid gardener or require significant storage space King (2014).

Further, critics state that the size of housing has a direct impact on its inhabitants' mental health, connecting social health and depression with tightly packed living quarters (Sobel Fitts, 2016). Friedlander (2016) also suggests generally that for the generation of seniors, micro houses are not well designed when it comes to accessibility for seniors' due to the cramped spaces, lofts with ladders and bathrooms too small to accommodate walkers. Urist (2013) suggests that the health risks of living in small spaces may outweigh the benefits.

Additionally, the issue of density is raised when evaluating micro housing. Although micro apartments are capable of adding to density, individual micro houses create the opposite effect of adding to urban sprawl and reducing land availability (Friedlander, 2016). Critics also point to the greed of developers, stating that they can potentially take advantage of consumers by charging a premium price for the smaller sized units (Sobel Fitts, 2016).

3.2 POTENTIAL CONSUMERS

The second area of focus identifies potential consumers of micro housing by exploring the relationships between demographic changes and the demand for housing. This approach is akin to a study first undertaken by Mankiw & Weil in 1989 (Eichholtz & Lindenthal, Demographics, human capital, and the demand for housing, 2014). To perform this research, computer modelling is used to project the population growth over the next 30 years. The modelling is completed using the software program Simul8, which is designed to create visual models and to predict population changes (Simul8, 2017).

For purposes of this research, initial parameters (i.e. demographic and population statistics) are collected from Statistics Canada. Data in the model is then simulated based on different courses of action, to produce the corresponding scenario results, and

to assess the strategic impact of the chosen option. The modelling used for this research is aimed at projecting the population shifts using age-banding which is shown to directly impact the demand for micro housing. The population growth was separated into five-year segments, then gathered and presented by generation to establish the demand for housing and identify any gaps (i.e. affordability, availability). These projections combined with the literature reviewed inform the sub-questions:

- 'Who will purchase micro housing and
- 'How will changes in future population affect demand?'

The literature suggests that a study of the population demographics in the future is necessary to evaluate the “overall land use and community facility needs” associated with small housing (Kaiser et al, 1995; Pitts, 2004; Frumkin et al. 2004). Projecting future growth, to answer the research question, of future demand, incorporates taking a long-view (2017-2047) and the results grouped by age and gender and corresponding changes in size. These results are compiled from the data produced by Simulat8 which calculated the population and its changes in five-year intervals for the period of 2017 – 2047.

The review of the literature highlighted that the shift in demographics has already impacted the availability and affordability of housing and future population growth will demand more affordable housing options be available to Canadians (Gottberg, 2016; Kaiser et al, 1995). Affordability, as previously stated, is defined as home owners paying no more than 30% of their total household income on shelter expenses (Statistics Canada, 2016).

3.2.1 WHO WILL PURCHASE MICRO HOUSING?

To determine who will purchase micro housing, computer modelling software, Simul8, was used to establish the population changes in the future. The literature reviewed suggests that the age banding of the consumer demographics is fragmented and not grouped into one specific consumer cohort. It has been suggested, however, that there is more of a demand for micro housing by individuals living alone (single households) versus those with families (family households) (Gloria, 2016). For this research the generations of millennials, baby boomers, and seniors are assumed to be the potential consumers of micro housing owing to their level of buying power and influence over the demand in the housing market (Quigley, 2016; Dexigner, 2015, Gottberg, 2016; Kaiser et al, 1995).

Quigley (2016) specifically suggests that millennials (those in their 20's and early 30's) have a keen interest in micro-housing. The review of the literature stated that millennials are interested in living debt-free and minimizing their environmental footprint, and view micro housing as the suitable solution (Jones, 2017). It is further noted that

this generation is more interested in purchasing housing that provides for what they need versus living with significant debt (Schaefer, 2016). The literature reviewed suggests that small homes help millennials to create the environment of a richer lifestyle they are seeking through experiences rather than material things (Gottberg, 2016; Shaefer, 2016).

Aston (2015) suggests that downsizing is a retirement strategy for baby boomers, stating that trading the 3+ bedroom home for a smaller condo can free up cash from equity to support a more idyllic retirement lifestyle. Alternatively, Roth (2017) suggests that boomers choosing to downsize into tiny houses are looking for freedom, control over their retirement funds and the ability to live with less. Yet, Canadian Mortgages Inc. (2016) suggest that not all boomers are interested in downsizing, that some still wish to have space to hold family functions and have family overnight visits or living with them.

Dexigner (2015) suggests that small space living is being sought by some of the aging population to facilitate easier living. It is also suggested that micro homes be added to existing family property for aging parents and relatives so that individuals can have their own living space but still belong to a family-unit (White, 2016; Carter, 2015). The literature makes specific mention that widows and single seniors find living in a tiny house less stressful and more rewarding (Spesard, 2017).

Gottberg (2016) suggests that the cultural shift to reduce material possessions is evidenced in the growing number of people downsizing to live more simply and more affordably. The literature reviewed suggests that advice has become widely available to assist people with simplifying their lives and deciding on “whether to keep necessary items that may or may not bring joy” (Kondo, 2017).

The concept of simplicity is further echoed by literature surrounding the concept of affordability, stating that this is the key to making small space living attractive to potential consumers, especially millennials (Dawid, 2014). Marr (2016) suggests that millennials are less likely to purchase larger sized homes in favour of smaller condos. This literature connects the sub-questions of ‘What is the demand?’ and ‘Who will purchase micro housing?’ and further exposes the need to examine the generational interest in connection with affordability.

3.2.2 HOW WILL POPULATION CHANGES AFFECT DEMAND?

How the population changes and how it will affect the demand for micro housing in the future is discussed in this section. The literature suggests that the shifts in the population and the culture are changing not only the size requirements of housing but also the functionality (Post, 2014; Dexigner, 2015; Quigley, 2016). Post (2014)

suggests that with smaller spaces consumers are demanding multi-functional rooms and convertible furniture.

The authors suggest that smaller spaces have better floor plan designs and make better use of common spaces compared to their larger counterparts (Gauer, 2004; Dawid, 2014). In spite of this, Micro Showcase (2015) suggests that micro housing could remain a niche market as it appeals to consumers with very specific lifestyle needs. This is further supported in the literature that suggests micro housing meets the needs explicitly of the increasing population of single adults (Gloria, 2016; Dawid, 2013).

An assumption that has been identified is that consumers will still hold a desire to own a home in the future. Dawid (2014) suggests that more consumers are interested in renting spaces rather than owning, stating affordability as their top priority. Stearns (2014) suggests that “middle-class finances remain precarious” making micro housing a good option for the “soaring housing costs and shrinking incomes”. This literature connects affordability to the demand and addresses the sub-question of ‘who will purchase micro housing?’ It also relates to market sustainability, which is expanded upon in the following section.

3.3 MARKET SUSTAINABILITY

The third area of focus is market sustainability, addressed by answering the two sub-questions:

- ‘How will micro housing fill the gap in the market’; and,
- ‘How will it be sustained?’

Gottberg (2016) states that “growth without adjustment is unsustainable,” inferring the potential for other options. The literature suggests that with strategic planning and the use of urban planning constructs, communities can be built for the long-term (Frumkin et al, 2004; Pitts, 2004). Multiple authors agree that these alternative building concepts are changing both the landscape of urban planning and the community building requirements themselves (Frumkin, Frank, & Jackson, 2004).

They also suggest that using “smart growth” concepts (Frumkin, Frank, & Jackson, 2004), communities can not only be sustainable but can also positively impact the health of the residents. Gravel (2016) identifies this need for community and how urban sprawl has changed over time. He further supports Frumkin et al. (2004) that from an urban design perspective, remodeling infrastructure impacts the overall health and well-being of the population. Gravel (2016) submits that it is our infrastructure itself that needs to be altered to support this shift toward downsizing possessions and living in micro homes.

Urban planners agree that building for the future must include a variety of housing options, inclusive of “compact building design” (Frumkin, Frank, & Jackson, 2004). The review of websites on tiny house builders and small housing developers, highlighted there is a diverse range of building types being promoted for use shown to fit into a compact design style (Living Tiny Developments Ltd, 2016).

It is also suggested, that social, technical, economic, environmental and political areas have an impact on the sustainability of housing (Kaiser et al., 1995; Frumkin et al., 2004). This literature indicates the importance of sustainability for the demand of space, natural resources and community infrastructure (Kaiser et al., 1995; Friedman, 2010). Economic resources, specifically employment data, are stated as an “important determinant of population growth and change” (Kaiser, Godschalk, & Chapin, 1995). Whereby, Post (2014) suggests the importance of the technological advances available to a home owner through furnishings, components and beyond.

The environmental aspects are also suggested to have significant impact on the design of community developments (Pitts, 2004). This literature connects sustainability and the need for alternate housing options to the sub-questions of ‘How will micro-housing fill the gap in the market?’ and ‘How will micro housing be sustained?’

3.3.1 HOW WILL MICRO-HOUSING FILL THE GAP IN THE MARKET?

The authors of the literature reviewed for this research paper suggest that micro housing is the way of the future. Especially, as it merges architecture with the needs of inhabitants and that local zoning requirements must be reinvigorated to allow such efforts (Caravaca Gallardo, 2013; Gravel 2016).

Gravel (2016) suggests that residential housing needs to be protected and *in-fill* housing (i.e. the addition of micro housing to existing lots as “laneway houses”) is required to address the population demand. The review of standards, legislation and policies for housing in Canada, suggest there is a need for reform to address the gap between affordable purchase housing and rental properties (MacLeod, Worton, & Nelson, 2016). With the current standards across the country being varied and inconsistent, developers are challenged by the undefined concepts and standards of livability for micro dwellings (Sisson, 2017). However, even with the challenges posed by government policy, architects are finding ways to build on lots that may have been previously overlooked due to their size and shape (Martin, 2017). They are calling this “adaptive re-use” and use creative measures to build small homes with prefabricated units and shipping containers in lieu of the “diminishing city space” (Martin, 2017).

Whereas in the United States, the literature showed that companies in the non-profits, municipalities and in the private sector, are including micro housing as a feasible option to address the affordable housing gap (Perras, 2016). A specific example mentioned in the literature is the newly erected micro-apartment building in New York City, NY which offers efficient, affordable micro units in the city core (Brake, 2016).

Yet in Canada, there is literature that states that infill housing has not been utilized to its fullest extent and companies are being subjected to longer than necessary wait times, when it comes to obtaining building permits (Bula, 2017) supporting the previous finding that residential housing needs to be protected and infill housing needs to be added to support the population Gravel (2016).

3.3.2 HOW WILL IT BE SUSTAINED?

Pitts (2004) offers ten case studies that examine the impact of community planning, development, environmental issues and energy-efficient design. All of these factors are shown to impact sustainability. These case studies revealed the successes and challenges of sustainable micro housing in countries around the world (Pitts, 2004). The review of the literature provided several different recommendations on how to develop micro-housing communities, the cultural shifts required to adopt a micro-housing lifestyle, and how to maintain the sustainability of micro housing in the future (Kristensen, 2007).

The literature makes a clear point of noting that planning must be reviewed periodically to address known issues (i.e. size restrictions), unknown issues (i.e. not knowing what is in the ground until digging/ construction begins), known-unknown issues and unknown-unknown issues as they arise (Kaiser et al., 1995; Verzuh, 2016).

The identification of these issues forms the link between the identified risk factors and sustainability (Kaiser, Godschalk, & Chapin, 1995). The literature provided support for this approach by stating that issues must be identified as risks, and the need to develop a risk management plan mitigating the identified risks prior to establishing a micro housing project is mandatory to achieving a successful micro housing development (Kaiser et al.; 1995; Pitts, 2004; Verzuh, 2016). The risk management framework adapted from Verzuh (2016) was used to support the risk assessment approach presented in the analysis section of this research paper.

Also, many authors suggested the need for regulation to ensure a quality of life standard for micro home developments (Frumkin et al, 2004; Caravaca Gallardo, 2013; Gottberg, 2016; Pitts, 2004; Gravel, 2016). These authors suggested a synthesis approach. This approach suggests the appropriate scale must be examined and considered (Pitts, 2004; Kaiser et al, 1995). Pitts (2004) suggests a certain size for space (measured in square footage) must be determined to be “reasonable” for smaller space living and provides a supposition into the target market that would be interested in this type of home. This supposition supports the literature findings shown in section 3.2.1, which in explores consumers and the sub-question, ‘Who will purchase micro-housing?’

This method of establishing reasonable sizing requirements is similar to what has taken place in other successful small space developments in Denmark (Pitts, 2004;

Kristensen, 2007). The literature suggests that without the necessary sizing requirements, developers have the potential of building too small, thereby negatively impacting the demand for micro housing (Morris, 2016).

Several factors are shown to impact the future of sustainability for micro housing (Friedlander, 2016). These are shown in the literature to include the lack of available financing options, the issues with meeting zoning regulations and the questions surrounding density and land use (Friedlander, 2016; Sisson, 2017). These factors are explored in depth in the following risks and benefits section.

3.4 RISKS AND BENEFITS

In section 3.3 Market Sustainability it was previously stated, that there are several risks shown to impact the demand for micro housing. To highlight importance of these risks on the research question, a risk matrix is included at the end of this section. This matrix summarizes the identified risk factors, the probability, impact and corresponding mitigation strategy. This information is used as evidence to support the detailed risk discussion in section 6.1: Risk Analysis.

The risks and benefits presented in this section are grouped into three areas. Namely:

- Individual health
- Affordability; and
- Environmental impact

3.4.1 INDIVIDUAL HEALTH

The literature suggests that the health of consumers living in smaller dwellings is at risk and is a concern to be evaluated prior to downsizing (Friedlander, 2016). Urist (2013) suggest provides the critique that living in smaller spaces can cause psychological problems, especially for adults living with children (Mok, 2014). It is suggested that claustrophobia and the feeling of being trapped can also be associated with living in such small quarters (Urist, 2013).

There is however several positive benefits to individuals living in micro housing suggested in the literature. Namely, one benefit is the feeling of having more control over living spaces and more privacy (Nierenberg, 2015). It also suggested that there is more emphasis placed on shared community spaces (Mok, 2014) which adds to the health of both individuals and communities thus reducing the health risk of being isolated. Further, Kilman (2016) suggests that living in tiny houses advances the ease of decision making, especially when it comes to environmental and social aspects, which is credited to an individual's simpler living foundations.

From the financial perspective, the literature suggests that the potential to live debt-free is shown to be a key motivator and a benefit of living in micro housing (Kilman, 2016). However, at present the initial outlay for financing a tiny home is still outside the standard mortgage industry (Thorsby, 2016). That said, CMHC (2016) suggests that with lower costs and less maintenance, more time and money can be accumulated and spent on lifestyle. This supports the findings from the review of the literature on millennials and baby boomers wanting to downsize and spend less on housing to achieve their overall goals of having more income to spend on life experiences as discussed in section 3.2.1 'Who will purchase micro housing?'

3.4.2 AFFORDABILITY

Although micro housing is stated to be a more affordable style of living, it is suggested that there is potential for developers to charge more per square foot for these dwellings than their traditionally sized counterparts (Mok, 2014). There is also literature that supports that micro housing is less affordable when compared to standard houses on a cost per square foot basis. For example, a micro housing is shown to cost \$134.00 square foot versus a standard house cost of \$115.00 per square foot (Modery, 2017). Whereby, several other authors suggested that because tiny houses can be built by their owners as a Do-it-Yourself project, the overall cost of own their homes is greatly reduced (Kilman, 2016; Beitsch, 2016; Lee, 2016).

It is suggested that a tiny house can be built in the range of \$20,000 to \$45,000 (CMHC, 2016); whereas the average market price of a one-bedroom condominium in Toronto, ON is \$532,032 (Kalinowski, 2017), and to live in Vancouver, BC's Westside, would cost an individual an estimated, \$969,579 (St. Denis, 2017). With the cost of micro housing being a fraction of an average apartment in either urban city (Toronto or Vancouver), it provides the potential for consumers to live within the stated definition of affordability. This relates also to the identified priorities of consumers discussed in section 3.2 Potential Consumers.

3.4.3 ENVIRONMENTAL IMPACTS

Sustainability and efficiency are key considerations for building micro dwellings (Smarter Growth Initiative, 2016). The literature suggests that space is at a premium and therefore compromises must be taken regarding the amount of personal possessions (Lee, 2016). It is further suggested that micro housing contributes to a positive impact environmentally (Kilman, 2016), adding to the motivations of consumers to build micro houses (Hurson, 2013). From the addition of more abundant green spaces and the reduction in carbon footprint, tiny houses built in communities have more positive effects than negative (Benfield, 2011). Further the literature suggests that a tiny house consumes 87% less electricity and produces 93% fewer pounds of Carbon Dioxide (CO₂) per year (Gabriella, 2014).

The positive impacts of this environmental benefit are in alignment with the Canadian Governments' carbon footprint reduction goals (Environment and Climate Change Canada, 2017) and relates to the sustainability of micro housing discussed previously, in section 3.3. Nevertheless, there is additional literature that supports an opposing view suggesting that smaller footprint homes consume land just as traditional sized homes and are not an effective method of adding density (Friedlander, 2016). These viewpoints are linked to the literature findings highlighted in Section 3.1 where density using micro apartments has been discussed in detail and was identified as more beneficial than a detriment to effective land use.

3.4.4 RISK MATRIX

The risk matrix provided in this section supports the identified risks and benefits discussed in the previous sections and provide the necessary information to inform the risk assessment section (see Section 6.1). The risks identified from the review of the literature are grouped by the three themes (i.e. individual health, affordability and environmental impact). The framework embeds these findings into the discussion and enables a prioritization of immediate risks (i.e. price per sq. ft. discrepancies) versus risks that have lesser impacts (i.e. claustrophobia).

RISK	PROBABILITY	IMPACT	MITIGATION
<i>Individual Health</i>			
Psychological Problems	Low	Detriment to individual health	Provide detail regarding potential health consequences to consumers prior to purchasing/ living in micro housing
Claustrophobia	Low	Detriment to individual health	Provide suggestions to counteract potential issues; provide information for support services to adapt to smaller spaces more comfortably
Control over life	Low	Improved decision making, less debt	Provide financial lending (i.e. mortgages) to encourage micro house living
<i>Affordability</i>			
Developers overcharge due to lack of price/sq. ft. ceiling and/or guidelines	High	Affordability removed from micro housing	Set standards for maximum price per sq. ft. eligible to be charged by developers based on location and permits obtained from and set by cities & municipalities
Do-it-yourself construction (unskilled builders)	Medium	Individual micro homes built at lower cost with potentially lower quality	Require building inspection to meet building code & by-law standards
Large initial outlay	Medium	May deter consumers without sufficient savings	Create financial lending solutions
Sustainable building materials	Medium	DIY builders may not cost materials sufficiently	Provide example listing of costs as a guideline for builders
<i>Environmental Impacts</i>			
Smaller amount of space, reducing things increases potential garbage	High	Compromises on volume of personal belongings	Provide downsizing tips / organization suggestions to reduce belongings
Carbon Footprint	High	Positively reduces energy consumption and carbon emissions	Suggest rebate programs for micro house dwellers
Land consumption	High	Land consumed to build housing	Increase land use density by incorporating micro housing

The literature reviewed in this section informs the discussion on risk and benefit analysis. This is shown in Figure 1: Micro Housing Research Design Diagram with its interrelated linkages to the other sections of this research paper. Section 4 provides a more detailed description and explanation of the research design and data collection methods used to complete this research study.

4. RESEARCH DESIGN & DATA COLLECTION

This research paper that uses existing literature in combination with computer modelling to support the concept of micro housing as an option to address future housing demand. It draws from primary and secondary literature sources that focus on the demand for micro housing in Canada. This research includes a comparison of Canadian practices to global practices, which are shown to be successful in the construction of micro housing. A diagram is provided for clarity and to support the search methodology used to inform the primary research question through the sub-questions and their interrelated connections.

4.1 RESEARCH DESIGN

The research design takes a literature approach through the collection of data from multiple sources and different mediums in both hard copy (books) and softcopy (electronic).

A diagram of the research questions is provided to illustrate the link between the primary question, the sub-questions and the risk & benefit analysis. The search parameters relied upon the use of existing data that was available through various sources and was searchable electronically.

Both qualitative and quantitative methods of research were used to seek information to respond to the primary research question. The qualitative method looked at questions such as:

- Why build micro houses?
- What is the demand for micro housing?
- How can it be regulated and maintained?
- How can it resolve the housing crisis?

These questions were analyzed using available data online from the real estate market, as well as through the government websites for Canada, the Province of British Columbia and the Province of Ontario. The quantitative method looked at the numbers to be summarized, described, and analyzed through graphs, charts and computer modelling. The aim was to find patterns and relationships in the data that would address

the primary research question of “*Is there a demand for micro housing in Canada in the future?*”

These research methods were used to enable a comparison between the produced results and the previously collected data revealing emergent theories and exposing the knowns and the unknowns. The research then probed further into the identified sub-questions based on these knowns and unknowns establishing a connection to the risks & benefits analyzed throughout the paper.

The three areas of focus (the demand, potential consumers, and market sustainability) provided the framework from which to delve deeper on a number of levels: national (Canada), provincial (BC and ON) and regional (Vancouver and Toronto).

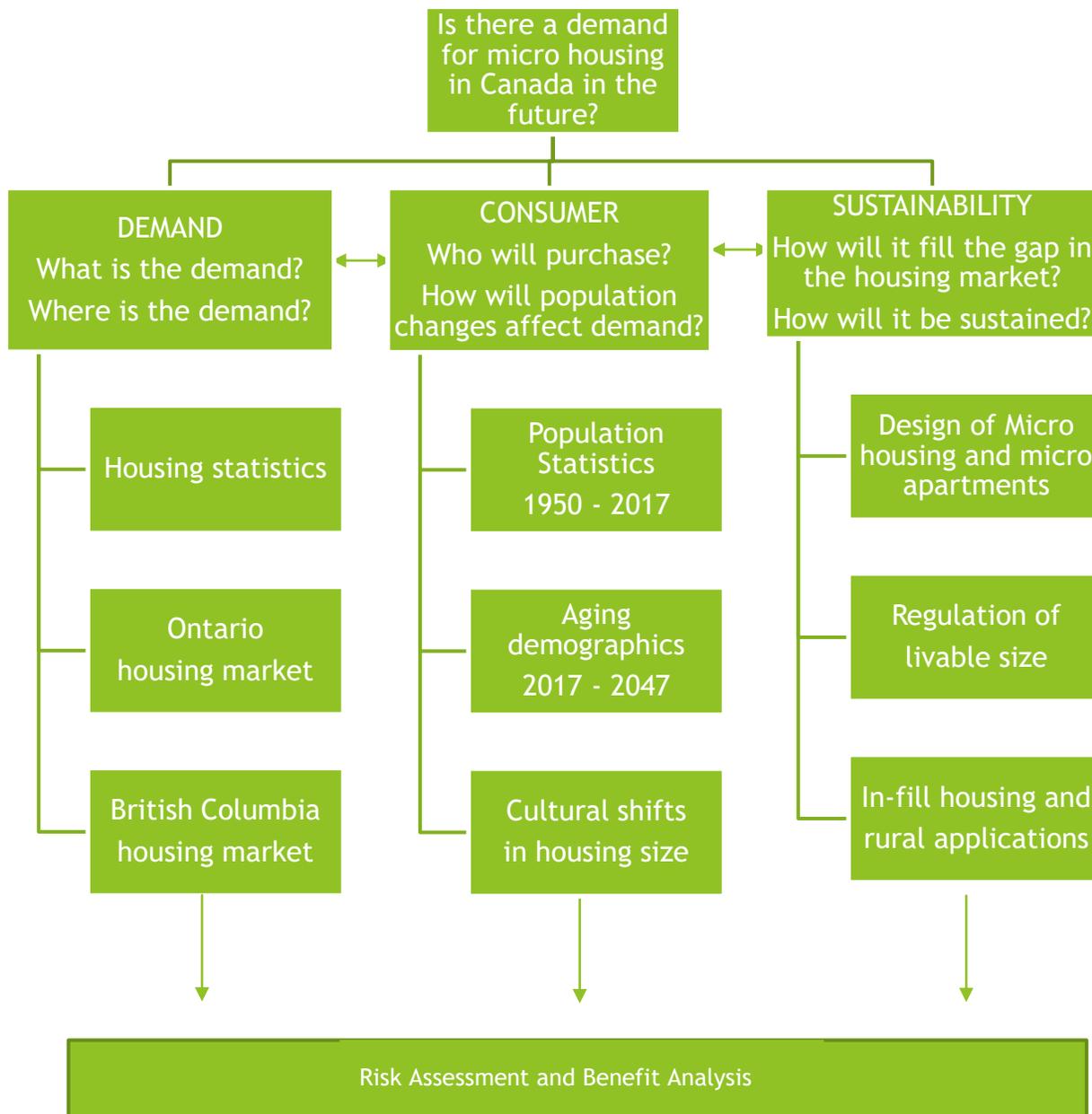
First to be reviewed was the demand, which required statistical information for Canada as a country and then for key markets in two specified provinces. Next, was the consumer that was identified through the assessment of the changes in the population. Statistics were gathered for the past 20 years (1997-2017) and were used to create a forecast for the population changes moving 30 years into the future (2017-2047). From these statistics, data was analyzed forming the potential demand by age group. To perform the forecast and determine the changes in the population demographics, computer modelling software, known as Simul8, was used. This identification of the consumer aided in determining their needs thus establishing a basis to respond to the focus area of sustainability.

Finally, the section on market sustainability looked at the design specifics of the micro houses themselves, the existing regulations in place (identified as supportive and/or inhibitive), and the use of micro-housing as in-fill in two of Canada’s largest cities. As information was gathered in each of these areas, the risks and benefits were also identified and are further detailed in section 3.4. The data was then grouped and analyzed on these three levels to identify the risk factors shown to impact future demand.

The compilation of the data into the associated sections of this research paper has provided results and responses to the questions posed and have also exposed areas of opportunity for further research.

The analysis and recommendations sections support the evidence from the review of the literature, embeds the statistical data collected and gathered, and develops a foundation for the simulation and forecast models. This leads to the analysis and interpretation of the results that identify the continuous assessment of the associated risks and benefits.

FIGURE 1: MICRO HOUSING RESEARCH DESIGN DIAGRAM



4.2 DATA COLLECTION

Figure 1: Micro Housing Research Design Diagram provides a clear illustration of the three identified areas of focus from which a wide variety of literature has been reviewed. The data was collected and synthesized from both primary and secondary sources. The primary sources included academic journals, abstracts from research papers, indexes from databases and computer modelling (to forecast population statistics). Secondary sources were statistics from government websites, online media, online news articles and physical books.

The following searches were performed to source the stated information (referring to the years 1997- 2017):

Books

Books were sourced from public libraries using the following key word searches:

- Urban planning
- Community and city design
- Urban Sprawl
- Sustainability
- Micro housing and small homes
- Design and architecture of small spaces
- Environmental impact of small spaces
- The aging population
- Cultural shifts to downsize living space

Academic sources

- Online databases of academic journals were searched using terms such as “urban planning”, “sustainable development”, “small space housing” and “affordable housing”. These were searched from accredited universities including:
 - Athabasca University
 - University of Alberta
 - Harvard University
 - University of Toronto
 - University of British Columbia
- Primary literature electronic databases were searched using the terms noted above as well as “future demand of micro housing”, “economic development”, “and sustainability for the future”. These include:
 - Harvard Business Review
 - MIT Management Review

- Canada Mortgage and Housing Corporation (CMHC)
- Canadian Real Estate Association (CREA)

Websites and Open Source Media

The following websites were searched for information specific to “population statistics” to inform the computer modelling software:

- Statistics Canada
- Province of British Columbia
- Province of Ontario

Google searches were also performed to identify:

- Successful small housing developments globally
- The cultural considerations that inform housing size and space globally
- The impacts of regulations on small housing developments globally (both positive and negative)

An Ancestry approach was also used to determine additional publications and sources which would inform the findings.

5. RESULTS

Through the completion of a thorough literature review, the following results are provided by sub-section then summarized to make connections that inform the primary research question. A critical analysis and interpretation of these results including the associated risks and benefits are presented in the analysis section of this paper (see Section 6).

5.1 INSUFFICIENT HOUSING SUPPLY

The research revealed that the demand for housing in Canada is already in a state of crisis (Ligaya, 2017). The lack of availability coupled with the lack of affordability further substantiates the need to explore alternative housing options. Evidence supporting this need for alternative housing options is provided through the presentation of vacancy rates and housing market pricing posted by Statistics Canada and Canada Mortgage and Housing Corporation; shown in Figures 2 & 3.

The focus of this research as previously stated began with evaluating two Canadian urban cities: Vancouver, BC and Toronto, ON. This was then broadened to include the perspective for trends in Canada. For each city, results were found for their housing demands in the present day and their potential outlook moving 30 years into the future.

Statistics specific to each city's demand are provided and inform the sub-question of *what is the Demand?* These statistics provide a granular look at the potential for alternative housing options, such as micro housing, in each of these cities based on their respective housing situations.

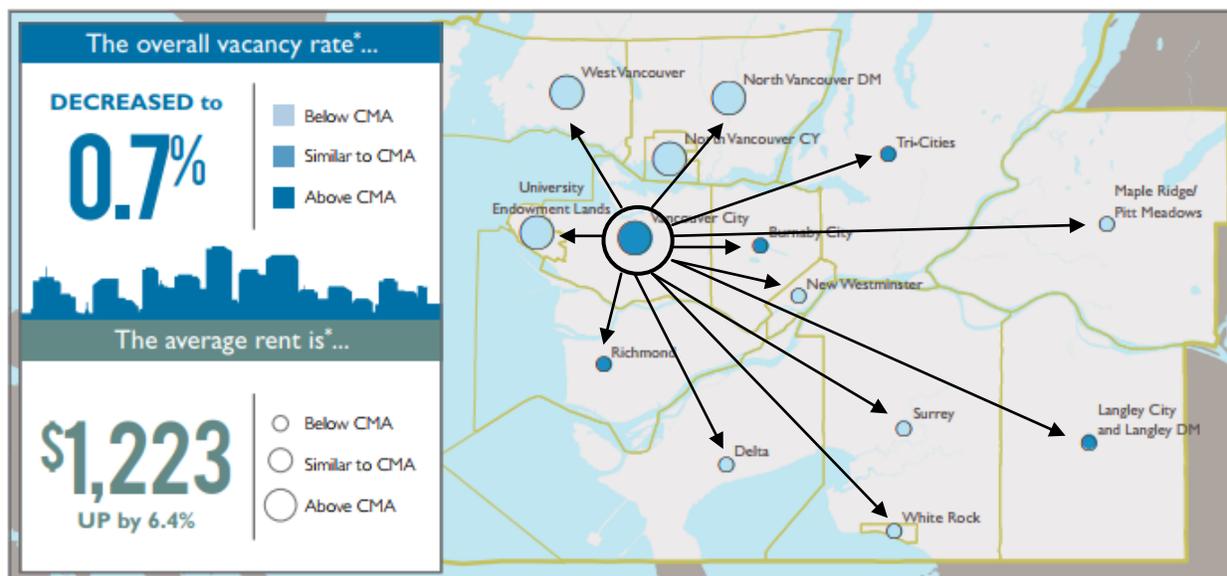
The results have shown that the current supply of available housing in 2017 is insufficient to meet the needs of the population in these two cities, let alone the rest of Canada. This underlines the need for alternative housing solutions to be implemented to relieve the shortage in supply, to increase the potential in housing affordability and to provide sustainable housing for the projected future population growth.

In Vancouver, BC, the vacancy rate is only 0.7% (CMHC, 2016) leaving little room to house any growth in the population. It is suggested that the Strong market demand combined with the limited availability is keeping vacancy rates below 1% (CMHC, 2016). This statistic further establishes the state of the housing crisis being faced and the immediate need for alternative solutions.

Figure 2: Vacancy rates and average rents for the greater Vancouver Regional District (GVRD) shows that the prices of rentals are higher nearest the downtown core, pushing consumers to move further outside the city center. This is depicted in the size and colour of the dot in each municipality. The **darker blue dots** indicate higher vacancy and the **lighter blue dots** indicate lower vacancy than the posted 0.7% overall average vacancy rate for Vancouver, BC.

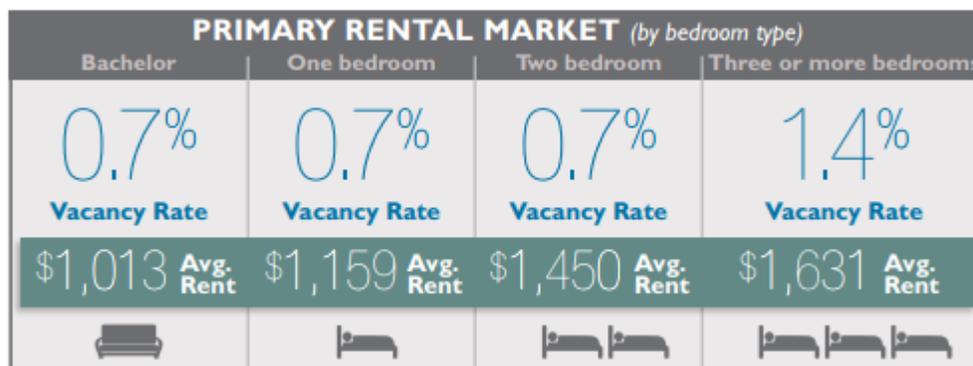
The sizes of the dots illustrate the rent prices and their relationships to the vacancy rates. The **larger the dot** the higher the rent as compared to the posted average rental rate; the **smaller the dot**, the lower the rental rate compared to the posted average. The **arrows** that overlay the map show that moving outside of the city may provide lower vacancy rates, but indicates that rental prices are about the same as those posted in the city centre (Vancouver city). Further, moving to the outskirts of the city only adds to costs borne by residents through transportation needs (for those working in the city center). This diagram supports the finding that living outside the city is no more affordable than living in the downtown core.

FIGURE 2: VACANCY RATES AND AVERAGE RENTS FOR THE GREATER VANCOUVER REGIONAL DISTRICT (GVRD)



Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

FIGURE 3: GREATER VANCOUVER PRIMARY RENTAL MARKET BREAKDOWN



Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

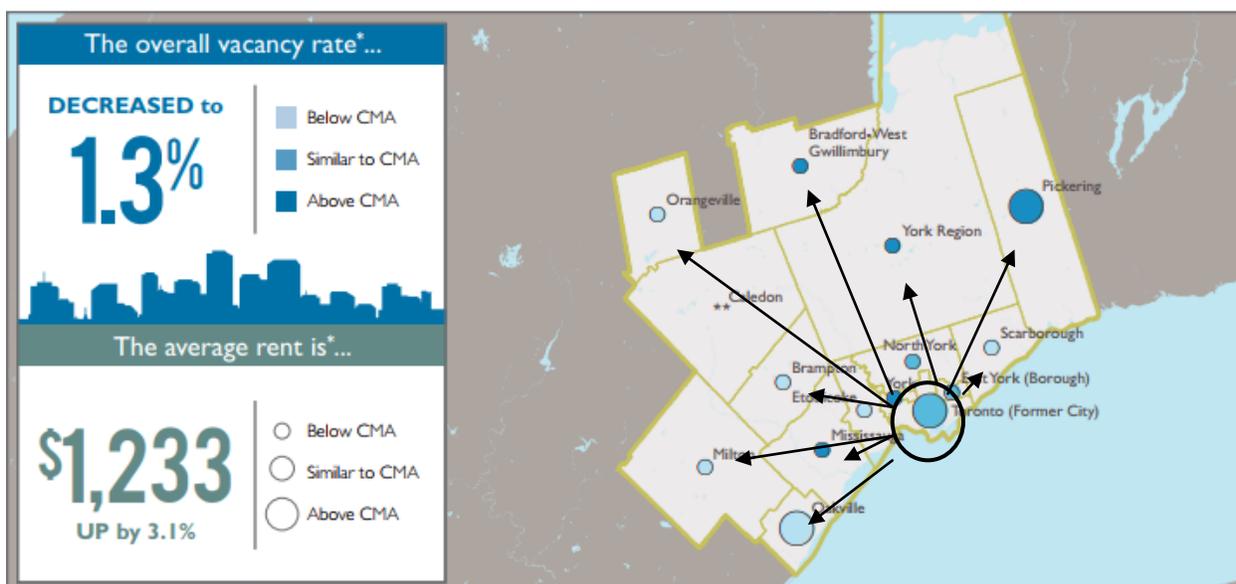
Figure 3: Greater Vancouver Primary Rental Market Breakdown illustrates the vacancy rates by bedroom type in the primary rental market (Vancouver City) and makes further delineation by size of apartment with the associated average rent. The key finding here is that smaller apartment sizes show the lowest availability and the highest demand.

The record high costs in real estate are pricing potential home owners out of the market as they are unable to afford the homes that are available (income levels cannot support borrowing needs to meet real estate prices) (CMHC, 2016). The inability of consumers to purchase real estate (due to income and availability) is forcing the increase in rentals and lowering the vacancy rates specifically in smaller size units (CMHC, 2016). These two factors are leading to the following:

1. A demand for smaller housing in Vancouver, BC,
2. Population changes are affecting the demand for smaller sized units (based on affordability), and,
3. A market whereby current housing supply is unable to sustain the housing market (vacancy rates).

In Toronto, ON, the posted vacancy rate is 1.3%, less than half of what the city considers to be healthy (Gadon, 2017). These results illustrate the status of rental housing and support the findings of the increased demand for alternative solutions in Toronto, ON.

FIGURE 4: VACANCY RATES AND AVERAGE RENTS FOR THE GREATER TORONTO AREA (GTA)



Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

Figure 4: Vacancy Rates and Average Rents for the Greater Toronto Area (GTA) reveal a similar status for the relationship between vacancy rate and rental rate as Vancouver, BC. The city centre in Toronto however has a similar vacancy rate to the average, with the higher vacancy rates showing in the outer regions of the area. As in Figure 2, the **colour and size of the dot** depict the vacancy rate and the rental rate in comparison to the posted average. The cities of Oakville and Pickering, that are a distance from the core, show the average price of rent is the same as what is available in the city centre. The **black circle and arrows** highlight that moving out the city is not necessarily a more affordable option.

FIGURE 5: GREATER TORONTO PRIMARY MARKET BREAKDOWN

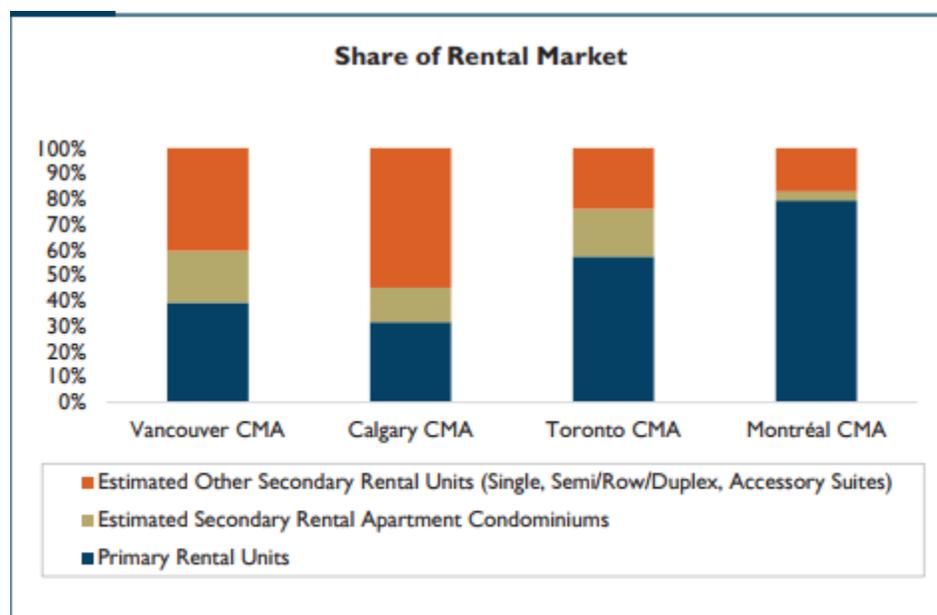
PRIMARY RENTAL MARKET (by bedroom type)			
Bachelor	One bedroom	Two bedroom	Three or more bedrooms
1.4%	1.3%	1.3%	1.8%
Vacancy Rate	Vacancy Rate	Vacancy Rate	Vacancy Rate
\$957 Avg. Rent	\$1,132 Avg. Rent	\$1,327 Avg. Rent	\$1,515 Avg. Rent

Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

Figure 5: Greater Toronto Primary Market Breakdown once again shows similarities to Vancouver, BC in that the most demanded units are those with 2 bedrooms or less. The interesting difference highlighted from this figure when compared to Figure 3 is that Bachelor sized units in Toronto, ON are not as demanded as they are in Vancouver, BC. This is noted in the vacancy rate for Bachelor units being slightly higher than those posted for one and two-bedroom units. The posted vacancy rate for bachelor units in Vancouver, BC is equivalent to the posted numbers for one and two-bedroom units. Overall, the smaller sized units (less than two bedrooms) are consistently posting the lowest vacancy rates showing the demand to be similar across both of these metropolitan cities in Canada.

Due to the lack of availability in rental units, it was discovered that bidding wars are taking place in Toronto, ON (Grief, 2017) marking another similarity to the Vancouver, BC market. Moreover, where housing is available, it may or may not meet with the definition of affordability as stated in this research paper (see Glossary of terms).

FIGURE 6: SHARE OF RENTAL MARKET (VANCOUVER, CALGARY, TORONTO, MONTREAL)

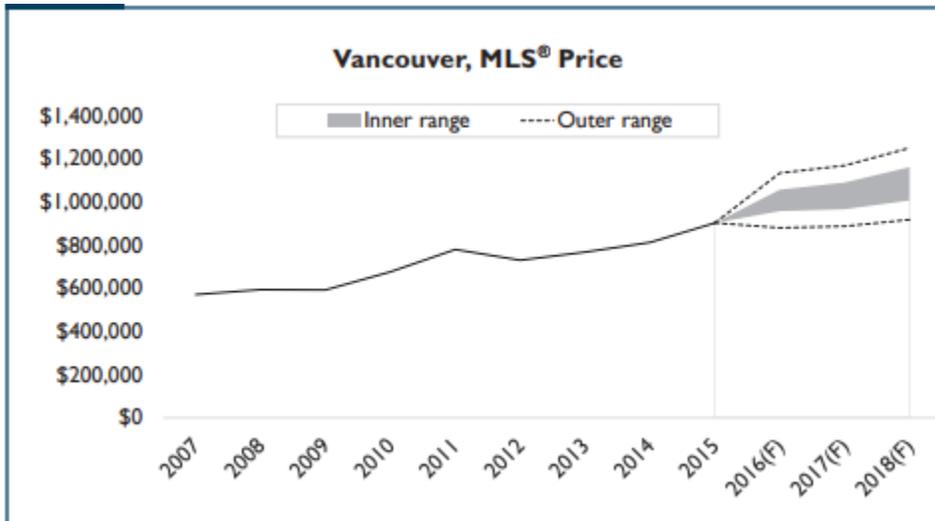


Source: CMHC Rental Market Survey, CMHC Secondary Rental Market Survey

By comparing the rental markets in Vancouver and Toronto in Figure 6: Share of Rental Market (Vancouver, Calgary, Toronto, and Montreal), the similarities and differences are identified and inform the demand as well as the percentage of the market that are demanding a specific housing type. Primary rental units (blue bars) make up a significant portion of the respective markets, yet the estimated other secondary rental units (orange bars) overtake all available options of rentals in both cities. The other secondary rental units market includes condominium apartments, laneway houses, and secondary suites.

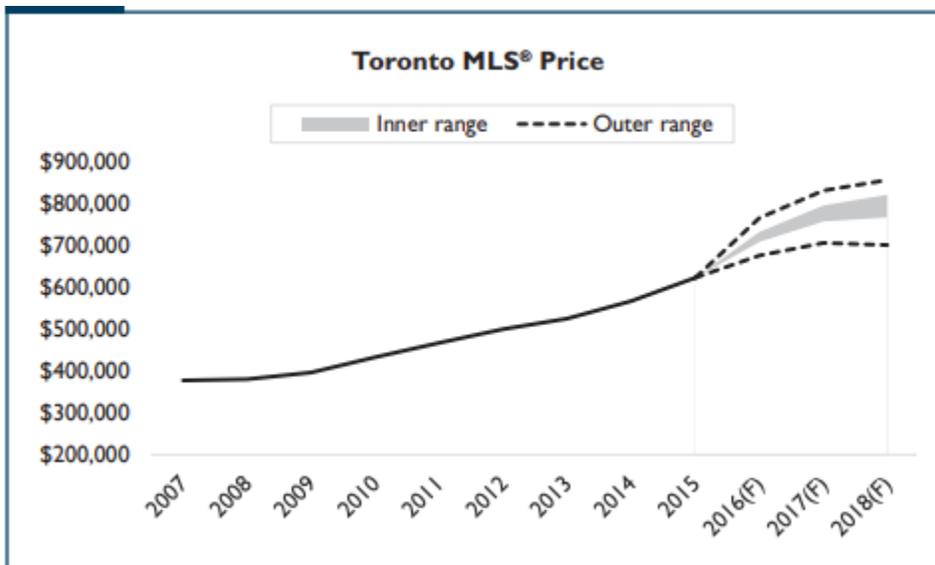
This finding is particularly important to Vancouver where the secondary market is shown to contribute to approximately 60% of all its rental units.

FIGURE 7: VANCOUVER MLS PRICE



Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

FIGURE 8: TORONTO MLS PRICE



Source: Canada Mortgage and Housing Corporation (CMHC, 2016)

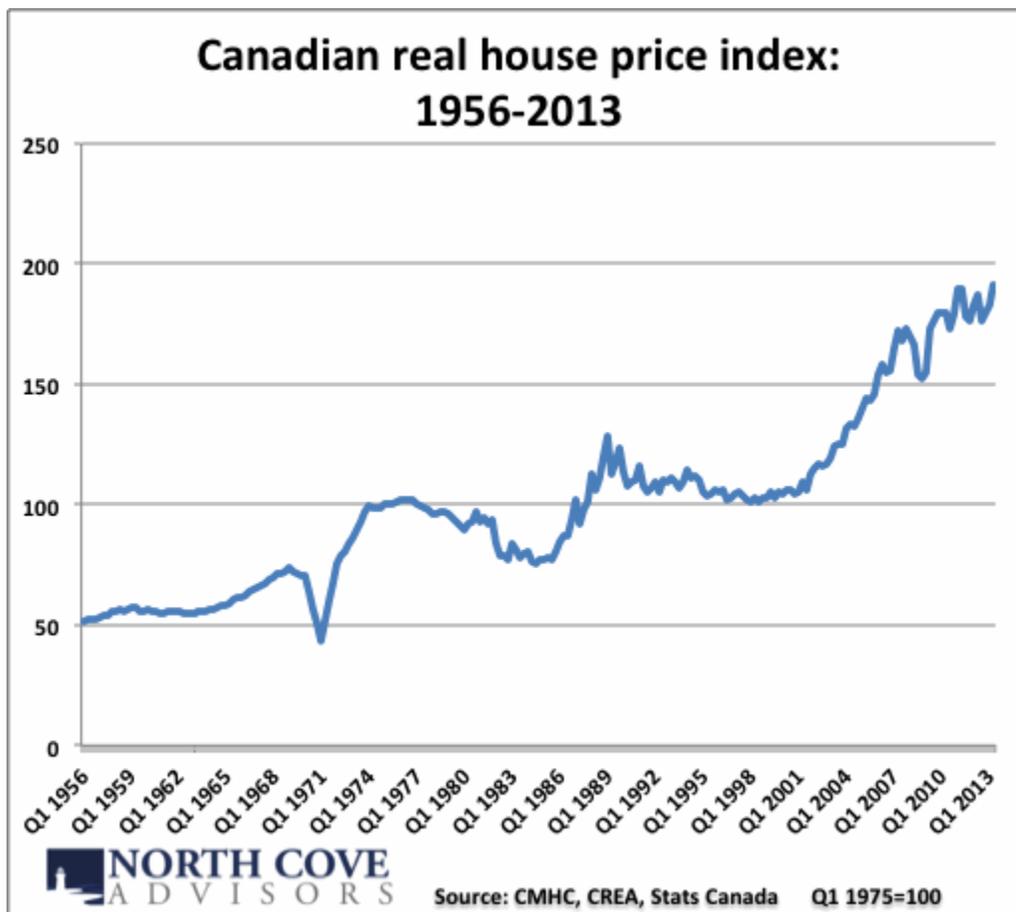
Now that demand has been established in both Toronto and Vancouver for rental units, it is necessary to understand what is driving this rental market and who will be capable of purchasing homes.

Figure 7: Vancouver MLS Price and Figure 8: Toronto MLS Price both show the changes in the price of housing for the respective cities going back to 2007.

In the Vancouver market, there is a marked difference in the price of housing, reaching nearly one million dollars in 2015. In contrast, the Toronto market posts housing price to be a little more than six hundred thousand. With these consistently rising prices in both markets, the ability for home buyers to enter the market is reduced. As prices increase, so do the required funds (i.e. down payments, etc.) for a home buyer to keep pace. This result is consistent with the finding there is a lack of affordable housing as well as a lack of available housing supply in both cities. The inability to purchase a home is driving more consumers toward the rental market, and as discovered, increasing the demand for smaller units to create affordable housing conditions. This result accentuates the need to increase the supply of available housing solutions within the consumer market that also meet the standards of affordability.

Widening our lens to the housing prices in Canada, Figure 9: Canadian Real House Price Index (1956 - 2013) illustrates the rising trend that began back in 1956 (Kirby, 2014). The results show that the price of housing has increased to such a degree that people are less able to purchase (StatsCan, 2017). The impact of this result has been an increase in the number of people renting which has continued to place downward pressure on vacancy rates (Statistics Canada, 2016).

FIGURE 9: CANADIAN REAL HOUSE PRICE INDEX: 1956 - 2013



Source: (Kirby, 2014)

The figures presented in this section along with the associated statistics for Vancouver, Toronto and Canada illustrate the gap in the housing market through availability and affordability that has emerged. This result indicates that alternative solutions, such as micro housing, have the potential to stabilize the market through both avenues (availability and affordability). A notable finding through the figures is in the forecasted future trends which show that the housing gap concerns (around pricing, supply and affordability) will continue to grow if a solution is not applied (CMHC, 2016; CMHC, 2016).

5.2 GENERATIONAL INFLUENCE ON DEMAND

To inform the sub-question *who will purchase micro housing?* inferential statistics were used in combination with computer modelling to show how the population might change in the future. The statistics produced establish consumer groups through age banding and forecast the changes in these groups 30 years into the future. The results of these forecasts show that the largest number of consumers will fall into two generations, millennials (born between 1982 - 2004) and baby boomers (born between 1946 - 1964) (see Appendix 2 and Appendix 3). These generations are driving the demand for housing needs and represent the key consumer market to be addressed (Jones, 2017; Quigley, 2016).

Appendix 2 shows how the population is projected grow between 2016 to 2041 at the rate of 6.5% (Statistics Canada, 2016). Two-thirds of the population growth include millennials (aged 18 to 34) and baby boomers (aged 35 to 69), especially in the Vancouver and Toronto areas.

These two cities will require a multitude of housing options to be made available to support this housing demand. Moreover, the results show that the current supply of housing is not meeting the needs of the population in these two cities, or in Canada nationally. This evidence supports the findings to answer the sub-question *How will population changes affect demand?*

It was previously stated that these two consumer groups (millennials and baby boomers) are looking for simpler housing more time and money can be placed into their lifestyles and enjoying life experiences (Kippist, 2013). This finding shows that a cultural shift mimicking previous eras such as the 1950's is underway. The 1950s was marked by a simpler lifestyle that was more focussed on living within their means rather than on the use of credit facilities and excessive accumulation (Mathieson, 1999) . Mathieson (1999) suggests that this generation had a culture of recycling through reusing and repurposing items rather than throwing them out as a result of the war and other political unrest which added to scarcity.

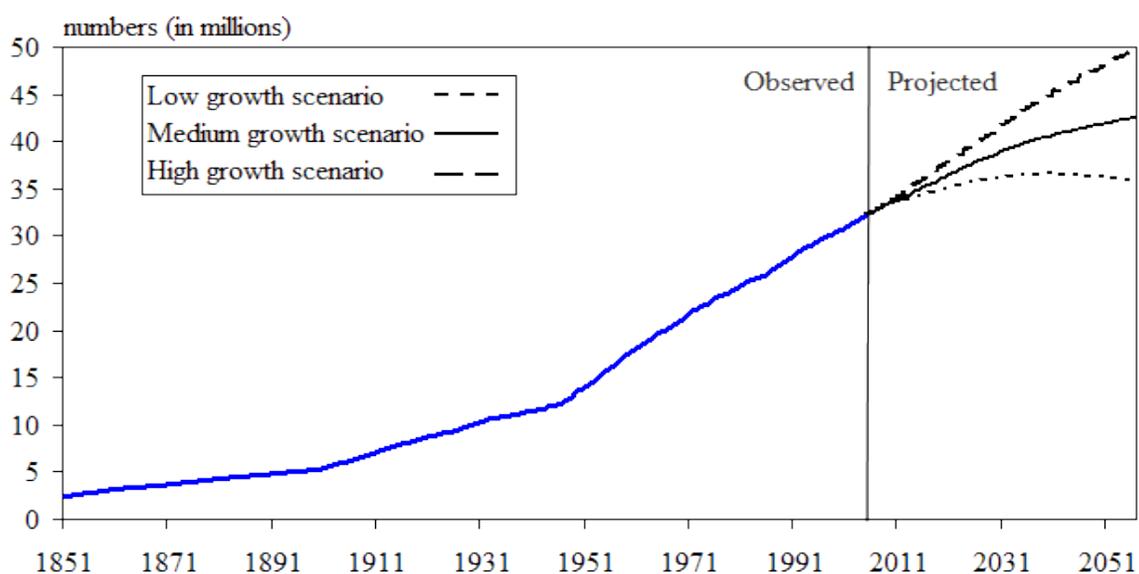
In 1947, the average size house was under 1,000 square feet (Nelms, 2012). By 2014, the average size house was 2,700 square feet providing a bathroom for each bedroom and demanding more and more space for the storage of accumulated possessions (Dietz, 2014). In addition to the larger house in 2014, the results showed that it was common to also have a rented storage locker in an off-site facility (Rosen, 2017). As society moved through the technological revolution of the 1990's and 2000's, the promotion of and participation in consumerism reached an all-time high, forming a "throw away culture" (White, 2016). This culture formed the basis for the need to accumulate possessions and purchase larger homes to have physical proof of success (Gauer, 2004; Zeiger, 2011).

These are key findings that highlight the inter-relationship between the past and the present emergent cultural shift toward a more minimalist lifestyle.

From this current cultural shift, the desire to reduce consumption and waste is highlighted making smaller living facilities an appropriate solution (Hurson, 2013). The lack of storage space forces occupants of micro housing to live more consciously and to fully utilize the available space (Schaefer, 2016). Results show that the potential to reduce financial liabilities is also an appealing feature of small housing, which adds to the stabilization of affordability in the housing market (Jones, 2017).

Figure 10: Population of Canada illustrates the change in the population in Canada dating back to 1851. The population growth increased gradually up until 1951 where there is a sharp increase in the population (in line with the birth of the baby boomer generation). This growth continued to climb at an increasing rate until 2005 (the solid vertical line in the graph). Looking to the future, Figure 10 forecasts how the projection of growth (low, medium or high) will continue to rise until 2031 regardless of the scenario, with the population expected to be up to approximately 40 million people. The population forecast lines then split with medium and high growth scenarios showing a continued upward trajectory until 2051. This indicates the demand for housing will continue should any of these growth scenario forecasts be correct as the growing population will need to have housing.

FIGURE 10: POPULATION OF CANADA, 1851 TO 2056

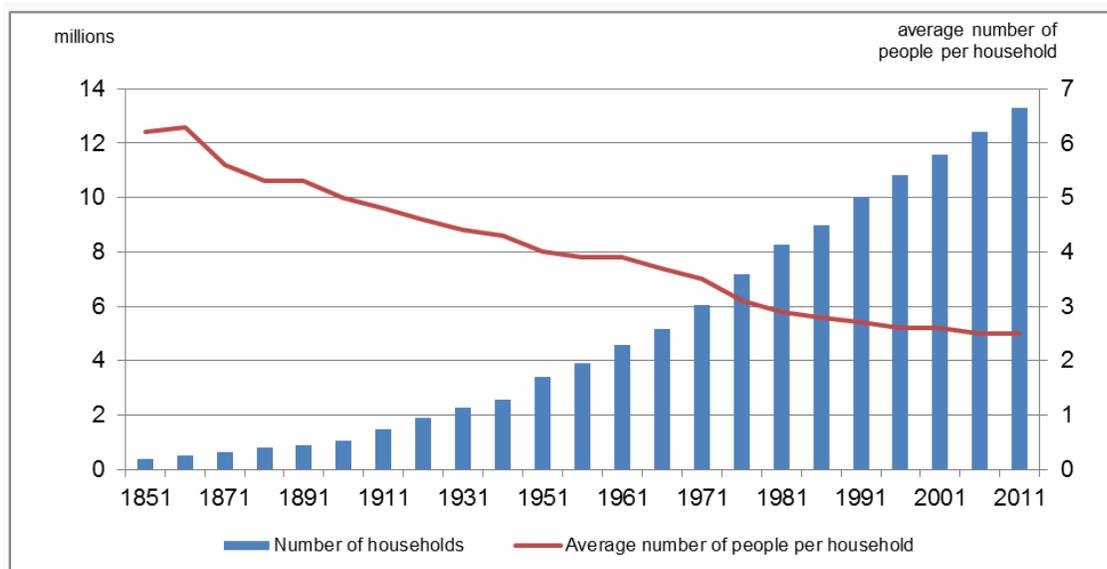


Data sources: Statistics Canada, 2005, POPULATION PROJECTIONS FOR CANADA, PROVINCES AND TERRITORIES, 2005-2031, Statistics Canada Catalogue number 91-520-XIE, scenarios 1, 3 and 6, censuses of population from 1851 to 1911, and Demography Division, annual population estimates from 1921 to 2005.

Figure source: Statistics Canada, 2007, Canadian Demographics at a Glance, Catalogue number 91-003-XWE.

The results also show that there has been an increase in the number of single occupant households (see Figures 11 & 12). Figure 11: Number of Households and Average Number of People Per Household in Canada (1851 – 2011) illustrates the gradual yet consistent rise in the average number of households from less than 1 million in 1851 to approximately 13 million in 2011. The trend line (in red) showing the average number of people per household during the same period has declined from more than 6 people to less than 3 people per household. The literature reviewed supports the result that smaller sized housing is in higher demand by single occupant households versus multiple occupant households at the regional level (Toronto and Vancouver) as well as the national level (Canada) (Cater, 2015).

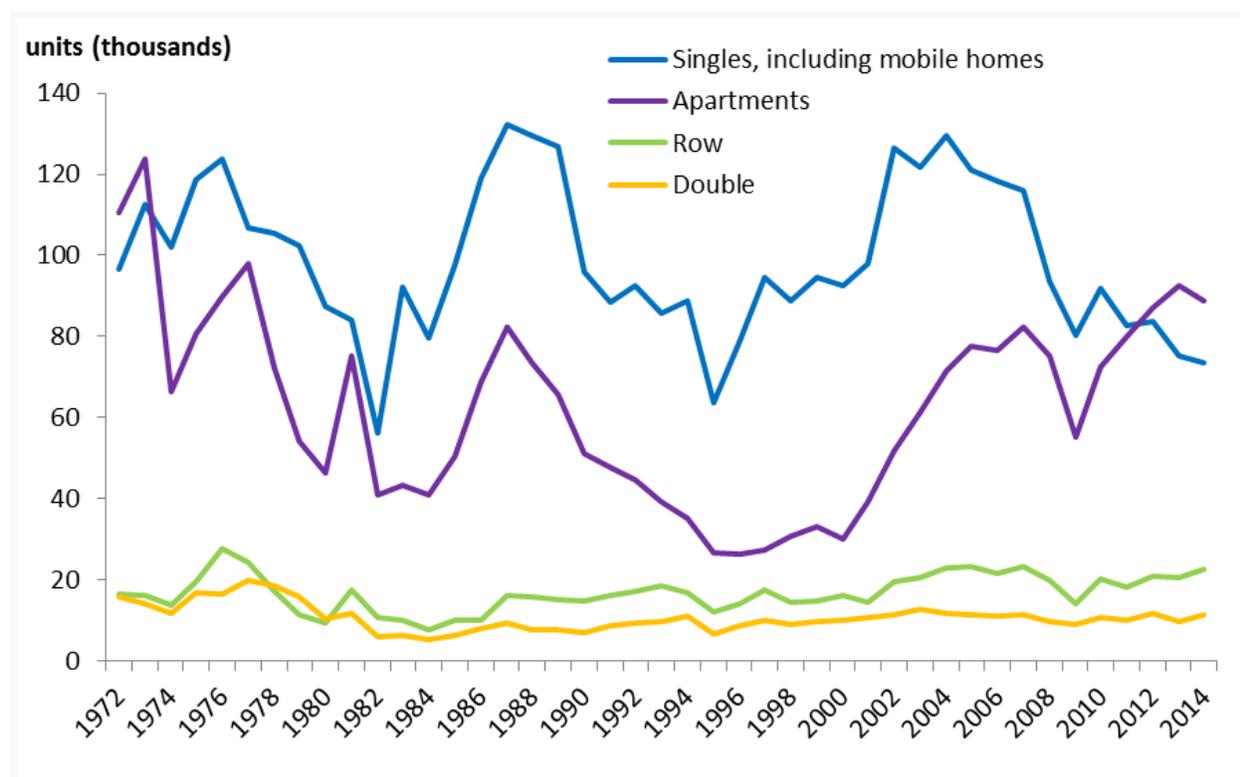
FIGURE 11: NUMBER OF HOUSEHOLDS AND AVERAGE NUMBER OF PEOPLE PER HOUSEHOLD IN CANADA 1851 - 2011



Note: Includes private and collective households from 1851 to 1921 and private households only from 1931 to 2011.

Sources: 1851 to 1921—B. Ram. 1990. *New Trends in the Family*. Statistics Canada Catalogue no. 91-535E. Appendix Table 5.1. 1931 to 1971—S. Wargon. 1979. *Canadian Households and Families*. Statistics Canada, Catalogue no. 99-753. 1976 to 2011—Statistics Canada, censuses of population, 1976 to 2011.

FIGURE 12: BUILDING PERMITS BY TYPE OF DWELLING, CANADA 1972 - 2014



Note: Each dwelling type includes those with a condominium ownership.

Source: Statscan: Evolution of Housing in Canada 1957 to 2014 (StatsCan, 2017)

Figure 12: Building Permits by Type of Dwelling (Canada 1972 – 2014) indicates the type of housing being built in Canada which also informs the demand. Specifically, through the higher number of permits being issued for single units and apartments (blue and purple lines), the gap in the market appears between traditional homes (row and double sized) and the smaller units (singles and apartments). These findings illustrate that the demand for smaller housing is being influenced by the growing population of single occupant consumers. This result informs the sub-question of ‘How will changes in the population affect demand?’ How this gap will be resolved and what measures can be taken to sustain supply are discussed in Section 5.3.

5.3 SUSTAINING SUPPLY

The results as stated earlier show that micro housing has the potential to alleviate the gap in availability and affordability for housing in Canada, but is it sustainable? Pitts (2004) noted that there are “three components to sustainable development: economic sustainability, environmental sustainability and social sustainability”.

The findings from the review of the literature suggests that the economic stability will come through meeting the demand for affordable housing. The results have shown that earned income levels are not meeting the inflated pricing of housing. Relying on the economics laws of supply and demand, the price of housing will be reduced once supply is made more available, thus creating a more sustainable outlook economically. The results have shown that environmental concerns are also incorporated within the building of micro housing through the building materials employed to the choices of the owners/ occupants and in the reduction in energy consumption. This triple pronged approach to address environmental concerns establishes a positive correlation between micro housing and environmental sustainability.

To address the aspect of social sustainability, the results concerning the consumer are reiterated. The findings surrounding the cultural shift in the populations to downsize and live more simply point to the consumer spending more time outside of their home. By spending more time in activities outside of the home, the social factors are raised to create social sustainability.

The key finding to creating sustainability by building micro housing, is the potential to use different applications. These different applications include: micro apartments, small footprint homes and trailer-style semi-permanent tiny homes. Figures 13, 14 and 15 illustrate a visual of these three different housing types and provide a description of the size, cost and benefits. These micro home options inform the sub-question of *How will micro housing fill the gap in the housing market?*

FIGURE 13: MICRO HOUSING APARTMENT TOWER



Image courtesy of Field Condition

Source: Dezeen.com: New York's first micro-apartment tower by nArchitects

New York's first micro-apartment tower was constructed in 2016 and is in such demand that over 60,000 people have submitted rental applications (Brake, 2016). The units range in size from 250 to 370 square feet and will rent starting at \$950 per month vs. the average New York 1-bedroom rental rate of \$3,400 per month (Brake, 2016).

FIGURE 14: MICRO HOUSE BUILT ON FOUNDATION



Source: Blu Homes <https://www.bluhomes.com/cabana-mini>

This 438-square foot micro house is built on a foundation and was named the 'Cabana mini' by its builders, Blu Homes (BluHomes, 2017). It is built as a prefabricated dwelling and assembled on-site. The company designs the homes and customizes them based on the site where it is to be placed. Depending on the options and appliances requested, this home can be built as a studio or 1-bedroom with a cost starting at \$170,000 (BluHomes, 2017).

FIGURE 15: TINY HOUSE ON WHEELS



Source: Mt. Hood Tiny House Village (Mt. Hood Tiny House Village, 2017)

This micro house is an example of a home built on a wheeled base that is considered to be a semi-permanent dwelling. The model shown is part of a vacation village in Oregon, USA that welcomes visitors to stay in tiny houses on wheels ranging in size from 175 to 260 sq. ft. The benefit to a house on wheels such as this is that the owner has the ability to take their home with them should costs rise and move to a more affordable plot.

The results of smaller housing as a cultural alternative in other global cities, such as Denmark, has proven to be very successful (Storgaard, 2014). They have seen measured increases to the level of happiness in citizens, a more sustainable lifestyle and less financial burdens (Amanda, 2011). These factors alone are shown to contribute to a healthier lifestyle; however, the research also suggests that living debt-free is a better position to be in psychologically (Kuchar, 2014). Happiness, lower debt burden and psychological benefits are identified as risks in the risk and benefit matrix (see Section 3.4.4). A more in-depth analysis of these benefits is described and explained in Sections 6.1 and 6.2.

The sustainability of micro housing is dependent on several factors. These include the acceptance of smaller dwellings into the building codes, the creation of new standards for livability, and the availability of consumer mortgage financing. Also derived from these results is the need for developers to build on smaller plots of land and to employ architects that are willing to be more creative with multi-functional space solutions (Friedman, 2010).

Finally, the results show the need to incorporate sustainable development practises such as rain water harvesting, alternative energy sources (i.e. solar, geo-thermal, wind), and building materials (i.e. bamboo) in order to establish sustainability of micro housing in the future (Post, 2014). In the next section, the analysis assimilates this information on sustainability and provides deeper insight into the potential for micro housing in Canada.

6. ANALYSIS

The following analysis takes a critical look at the results provided in this research paper. The addition of a risk and benefit analysis adds to a balanced approach to responding to the primary research question and leads the reader to draw conclusions and recommendations.

The introduction for this research highlighted the issues surrounding the strain in the Canadian housing market. The specific markets of Vancouver and Toronto provided a clear picture of this strain that residents are facing in the home ownership market and in the rental market. The direction was then set to explore the demand for housing itself, to identify the consumer population and how to sustain housing in the future. The findings of this research have revealed that the housing crises has only just begun and solidifies the need for alternative and affordable housing options in Canada.

The generally accepted consensus that real estate in its major cities has become unaffordable is not in itself new information, however discovering how this affordability

gap has influenced the needs in the housing market provides insight into what recommendations can be made to remedy the situation. In the data, the demand for smaller sized housing in particular emerged as the most prevalent need and choice. Although this result was unexpected, it aligns seamlessly with the conceptual basis of this paper to build micro housing. This suggests more research into reasons why smaller homes are in demand.

The results showed that the key factors influencing the desired home size were cost and location. With earned incomes being outpaced by the inflation in the housing markets, both for rentals and home ownership, it only makes sense that cost be a key determinant for consumers. The price of housing is shown to be higher the closer the location is to the city center. This direct correlation between price and location is important to consider as we assess the pricing that micro housing boasts later on. Although it is expected that housing locations closer to the cities will have higher prices, what was not expected was the conclusion that living in suburban areas cost the same once transportation costs were factored in. The apparent difference between living in the city and in suburban areas is the opportunity cost related to time.

A key theme presented was the cultural shift of the population at large wanting to spend more time living and creating their preferred lifestyles than investing in larger homes. Time then becomes a key determinant also in deciding where and how a consumer will live. By living in the outer regions (suburban developments and beyond) the amount of time spent in a daily commute robs the consumer of the time they could be spending enjoying their chosen activities. However, as has already been established, to remove this barrier to preferred activities (commuting), a premium must be paid through higher prices and smaller spaces.

The alternative solution presented for the housing crisis in Canada is micro housing, with the main thought being that smaller living quarters will best suit those looking to spend their incomes outside of their homes. This illustrates the change in culture from purchasing real estate and accumulating possessions to the idea that things are not the answer to a fulfilling life (nor is the purchase of real estate necessarily).

This vein continued in the research through the rise of minimalism and the shift to reduce consumption and personal possessions. The era of accumulation has been presented to have reached its apex and is now turning back toward a more balanced lifestyle approach. By normalizing the amount of possessions, consuming what is needed, and consciously choosing more sustainable options, consumers are effectively moving the market.

Where previously the market place was the key influencer and driver of societal needs, consumers have taken back their power in making demands that are more conducive to a sustainable life. The results continue to show this through the desire to spend less on

housing and to find a more balanced financial approach to their life (i.e. less house, less debt, more enjoyment).

It was also revealed in the research surrounding downsizing that a simpler existence is not without its spoils or struggles. Experts in the field of organizing have become household names that provide strategies to reduce the volume of accumulated possessions. This reduction in things showed in the results to create happier people. Just how much a simpler lifestyle or a smaller home are truly impacting the level of happiness in the population are unknown and fell outside the scope of this research paper. With the limited information provided regarding the potential for healthier living from smaller dwellings and comparing to the success in other countries such as Denmark, there is a link between living with less and increased happiness. This link has logical merit in that consumers are spending more time and money in desired activities and therefore enhancing the enjoyment of their lives. It further supports the reasoning for the high number of consumers willing to live in smaller sized apartments in city centers, as it saves them time and money through reducing their need to rely on transportation owing to proximity. This draws a direct connection to the research sub question of where the demand lies.

Not all consumers are willing or able to pay the premium cost of living in the city centres and must either choose or be forced to look at suburban areas and communities in the outskirts. The research identified that land was more available outside of the city and is cheaper the further the distance becomes. This again sits with reason that the land furthest from the city is less desirable because of the associated commute and additional costs of transportation and is therefore cheaper to purchase. However, as mentioned, the finding that those living in areas further outside the city are paying no less for housing once transportation costs are factored in was surprising.

The logic is clear that building micro housing in the city provides more supply to those that can afford the premium pricing. However, adding in-fill housing in the sub urban areas using micro housing (in the form of lane-way housing, etc.) is an area of potential that can increase the density of the immediate communities outside of the city, and reduce the potential costs of time and money associated with longer commutes. This begins to shape a picture of the consumer who will purchase micro housing and how the changes in the population are impacting the need for their development.

The findings indicated that the current housing supply is not meeting the demand in the market and will only be further exacerbated by future projected population growth. Over the next 30 years the population is expected to grow by approximately 30%. If alternative solutions are not implemented, the increase in housing demand is likely to out run the supply.

6.1 RISK ANALYSIS

The results show that the risks associated with micro housing are grouped into three different categories of risks: (1) individual occupant risk, (2) building and (3) adoption risks.

Starting with risk 1 individuals, the results from this risk suggests that several concerns were stated regarding living in small quarters. The findings however were predictable as they were previously discussed in section 3.1.2 but add claustrophobia as an additional concern. The results showed that other risks associated with living in small quarters pointed to the loft style bedrooms and ladders. Though not all micro housing is designed with loft bedrooms, these results are logical and do provide insight that consumers will have to have physical capability to climb into lofts if there home contains one.

To assess the risks inherent with building micro housing, identification of both the known and unknown risks were identified, prioritized and addressed. To align with micro housing, a risk assessment framework was adapted (Verzuh, 2016). Figure 16 incorporates the two types of risk, and a contingency plan for the identified potential unknown-unknowns that are to be included if the risk assessment is to be inclusive and effective.

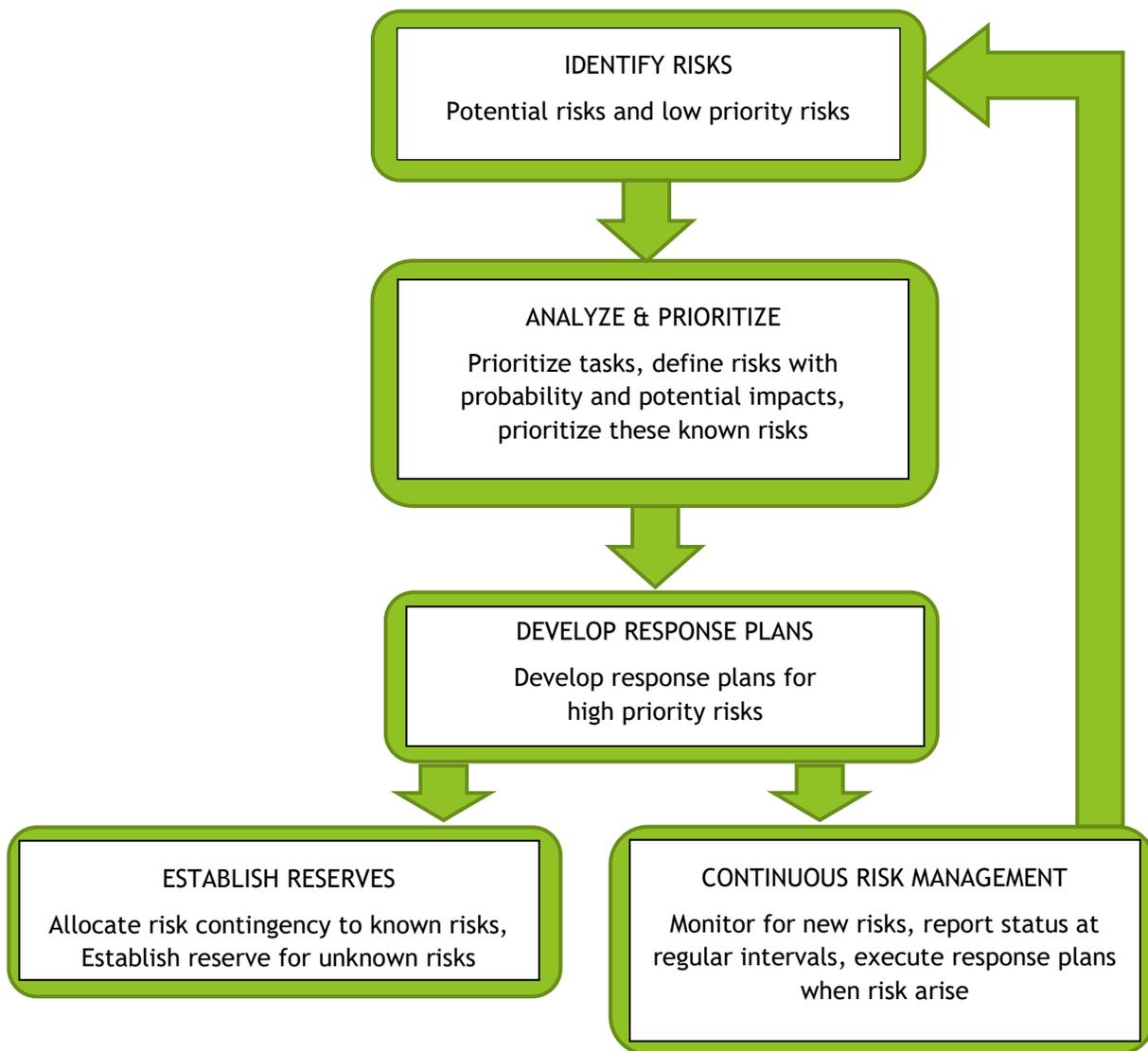
The risk framework employed is drawn from Verzuh (2016) which takes the project management perspective of risk assessment (see Figure). This framework is applicable for individual micro housing project developments but can also be adapted.

Figure 16 lists the steps required in the framework and shows the flow of these steps, indicating the circular function of continuous risk management. The framework begins with identifying the risks of micro housing and prioritizing both the potential risks and low priority risks. These include the health of residents, affordability, sourcing sustainable building supplies, land available to build, permits available, legal size requirements, certifications and inspections. Next is the analysis of these identified risks and their prioritization according to probability and potential impact. After the analysis of the identified risks has been completed, response plans with mitigation strategies are assembled. To ensure that risks are appropriately covered from a cost perspective, reserves are allocated for known risks as well as a management reserve for dispersal when unknown risks arise. The final step in the process is to continuously monitor the project for risk and to follow the risk management plan as issues appear. Should unpredicted risks appear, recommendations must be put forth to mitigate them with the purpose of keeping the project on track. A strong risk management plan is a required piece of the development strategy for the successful implementation of micro housing developments in Canada.

The results have shown that adoption of micro housing is potentially the largest risk to be addressed. The lack of classification for small homes, the building code restrictions and the urban planning constraints all contribute to adoption risk. The finding here is that although there are ways of skirting the codes and living in micro homes under the radar, most consumers are holding out for legal status to be recognized. Regulations and building codes must be expanded to include micro dwelling construction to combat the housing crisis and provide options to consumers who are demanding alternatives. The risk associated with continuing to exclude micro housing from codes will be the emergence of many illegal tiny homes, akin to the illegal suite situation that also currently exists in many homes specifically in major cities (Vancouver and Toronto).

The next section shifts from the risk analysis into the benefits of living in micro housing. It takes the approach of describing both the positive and negative benefits and concludes its analysis with the determination of whether micro house living is a solution for the population in Canada in the future.

FIGURE 16: RISK FRAMEWORK FOR MICRO HOUSING PROJECT DEVELOPMENTS



6.2 BENEFITS ANALYSIS

The benefits of micro housing begin with the availability of affordable housing for the Canadian population. From here however, the research uncovers other benefits and detriments that come with living in micro housing. These were explored for their potential impact on the three focus areas: the demand, the potential consumer, and the market sustainability of micro housing.

The results showed that the individual health benefits of residents of micro housing outweigh the potential negative effects. The finding that spending more time outside of the home, in social settings and enjoying chosen activities, creates a happier and healthier resident makes sense. The deeper connection to be made here is that the sense of community and importance of social relationships plays a larger role in the individual health of the population than a larger home does.

Affordability has been discussed as a key determinant for consumers to purchase micro housing, however, there are also health benefits associated with a healthy financial situation. The findings here make a direct connection between emotional health and financial stability. The results showed that heavy financial burdens from debt increased the emotional issues such as depression, anxiety and anger. They also revealed the positive results surrounding a healthy financial position include freedom, happiness and control. These results were an unexpected connection to be made to the sub-question of how micro housing will be sustained. In order to attract the targeted consumer, cost has been established as a decision-making aspect. To enhance sustainability of micro housing in the market place, the costs and benefits must be heavily promoted.

The results showed the positive environmental impacts of micro housing. It is logical to equate smaller homes with reduced energy consumption, however the finding of just how much less is consumed was quite startling; a 93% difference. If this is tied back to the sub-question of market sustainability, it establishes the benefits for the consumer, the developer, and the city or municipality in which it is built. By reducing the consumption of utilities and energy, there is a reduction in the carbon footprint adding to the overall reduction in carbon emissions for the city. The connection to the political agenda to reduce carbon emissions is inadvertent, yet relevant for influencing the change in by laws and building codes to accept the smaller built, energy efficient dwellings.

Figure 17: Benefits Realization Table provides a summary of the benefits of micro housing and the results of these benefits. Although there are only six benefits listed in the table, the weight of the benefits must be considered in their review. The benefits are listed in order of impact to the potential consumer, the general population and the environment. This figure indicates that availability and affordability make the largest impact to the potential consumer of micro housing.

FIGURE 17: BENEFITS REALIZATION TABLE

BENEFIT:	RESULT OF:
Availability of housing	Building more housing with smaller footprints
Affordability of housing	Smaller sizes warrant smaller prices
Enhanced Individual Health & Happiness	Spending more time outside the home, in social settings and enjoying chosen activities
Enhanced emotional health	Building relationships and community
Financial Stability	Reduction in debt burdens, better decision making, living within one’s means
Reduction in Environmental impact	Less energy consumption, less waste, less consumption of goods in general

6.3 LIMITATIONS

The results of this research cover three specified areas: demand, population and market sustainability, and is limited by scope and focus. Each area discussed in this research has the potential to be a research project on its own to provide greater depth an understanding as well as stronger connections to the applicability of micro housing as a solution to Canada’s housing crisis.

Further this research is limited by geographic location. By choosing to focus on two metropolitan/urban cities, the demand for housing is more easily identified. Whereas, rural areas, smaller cities and other provinces with smaller populations (i.e. Prince Edward Island) were not researched are also potential opportunities for micro housing solutions. This will require further research in the future.

Further study on the impact of the housing prices against the consumer demand is also an unknown for other cities where the real estate market is not inflated to the same degree of Vancouver, BC and Toronto, ON.

A further limitation of this study is in the construction of micro housing and the building materials employed. This finding would be especially important for areas such as Winnipeg, MB and in northern regions such as Nunavut where weather has more impact on construction materials and energy requirements.

In summation, the analysis and results support the potential for micro housing in the two urban centers used for this research study (e.g. Vancouver, BC and Toronto, ON). Although limitations and risks have been identified, there are also potential solutions available and unique design concepts that could possibly alleviate some of the identified issues highlighted in the literature. The beneficial health impacts of implementing micro

housing also contribute positively to the occupant and the environment. It is through this lens that micro housing becomes a potential positive solution for the housing crisis in Canada.

7. RECOMMENDATIONS

The following recommendations are aimed at influencing the acceptance of micro housing and alternative solutions in the housing market. The findings from conducting the research for this paper highlight the need for seeking alternative solutions to provide affordable housing to meet current and future demand. These solutions will necessitate changes to national, provincial and local legislation, policies and building codes and for consistency in alternative construction options. These recommendations are prioritized starting with an industry perspective at a macro level for Canada, then to a company perspective at a micro level for a company (e.g. Living Tiny Developments, Ltd.).

At a national level, it is imperative that Canada assess the country's current standards for housing to include provision for the shifting needs of the population. This can be achieved by evaluating micro housing as a solution to the housing crisis in several applications. It is recommended that at a national level, the government complete a study and / or implement the recommendations set out in several case studies generated by academics and partner institutions. These studies provide the evidence which supports the benefits micro housing can deliver to the Canadian population within the twelve months and into the future (December 2018). It is recommended that implementing these solutions would address the policy levers that are required to achieve the targeted results of providing Canadians with alternative affordable housing solutions.

The findings from conducting this research supports the need for the Canadian government to take immediate steps to create a national housing policy and strongly encourage the provincial jurisdictions to update their building codes to incorporate alternative housing solutions, specifically micro housing. These policies would set the pathway for implementing micro housing standards across Canada which includes incorporating a definition of affordable housing to ensure consistent approaches across the country.

Further, it is recommended that restrictions be removed regarding unit size for micro apartments and their sale immediately. This will create home ownership opportunities for the population that has been priced out of the market and provide additional supply of housing to meet the growing needs. To compliment this, it is recommended that the Bank of Canada create financing options specific to the alternative housing market that will bolster borrowing needs similar to the implementation of mortgage borrowing.

Lastly, it is recommended that the provinces create policy surrounding the use of tiny houses on wheels as in-fill housing. It is expected that this change be completed much

sooner than other building code and housing policy changes as it is quicker to implement. The creation of in-fill housing permits can be implemented immediately to grant tiny house owners legal living status and to add further options to relieve the demand in the housing market.

At a micro level through the company lens, it is recommended that Living Tiny Developments Ltd use the information of this study to develop varied design aesthetics for micro housing that specifically targets the millennial and baby boomer generations. The incorporation of additional storage needs or community buildings are also recommendations to consider. Potential targeted designs will become priority to market the development potential and will evolve over time as feedback is received and needs of the population change. These will be assessed through on-going evaluations at the project level through satisfaction surveys and purchase statistics against the overall market movements.

The next recommendation for any company looking to get into the micro-housing industry (i.e. Living Tiny Developments Ltd) is to reach out and develop relationships with apartment developers to create joint-partner arrangements for building opportunities. This will ensure knowledge transfer and that the company has access to the knowledge necessary to replicate their successful micro apartment building concepts in other cities in Canada and potentially on a global scale. It is recommended that these connections be sought immediately with the goal of a signed joint-partner agreement by the end of 2018.

Finally, it is recommended that companies (i.e. Living Tiny Developments Ltd) establish a standardized operational process for performing a targeted market analysis for each of their desired development locations. This process will compile market research using local data to advise management regarding the locations' potential. Figure 18: Micro Housing Location Development Assessment framework is suggested to be used for the compilation of this market research (though it is not exhaustive). The data required to complete the market research assessment is publicly available from city and municipal sources, and can be assembled through websites and in person requests at city buildings.

Section 1: Market Analysis synthesizes information used to assess land suitability, population interest and affordability for micro housing. Section 2: Land Assessment investigates the land available and evaluates its suitability to determine where there is space to build, what costs are associated for the purchase and development (i.e. permits, taxes, etc.) and what utilities are available or needed. Concurrently, marketing surveys and promotion of the micro housing concept (Section 5: Marketing Plan) can be disseminated to the target market including potential consumers, real estate professionals and property management companies. The feedback from these groups will inform the interest for a micro housing development, the specifics of the type of property to be built (i.e. small footprint homes, micro-apartments, etc.) and the most

desirable market pricing. Section 3: Financial assessment also incorporates information and statistics gathered to assess income levels by age band, historical and trending housing prices and forecasted population growth. Section 3 in combination with Section 4: Risk & Benefits Analysis assess the affordability within the region and establish the potential pricing structure to be included in Section 6: Recommendations for a micro housing development proposal.

FIGURE 18: MICRO HOUSING LOCATION DEVELOPMENT ASSESSMENT**Section 1: Market Analysis**

- Location – metropolitan, urban, rural, native reservation
- Population statistics – current and future projections
- Housing starts

Section 2: Land Assessment

- Locations of all available land for development
- Requirements for permits, etc.
- Building codes and by-laws specific to the region

Section 3: Financial Assessment

- Housing prices – current market pricing, historical pricing trends
- Economy – current factors affecting potential consumers and developers in the region
- Income levels – past and present employment statistics complete with incomes earned

Section 4: Risk & Benefit Analysis

- Known risks associated with building in the region
- Potential unknown risks
- Mitigation plan for all stated risks

Section 5: Marketing Plan

- Survey potential customers via real estate professionals, property management companies and social media
- Establish target market and assemble attraction strategy
- Create show suite customized to incorporate regional trends

Section 6: Recommendation

- Proceed or abandon development
- Factors influencing decision
- Potential for re-visiting location in future

8. CONCLUSION

The research conducted and analyzed in this study has determined that there *is* a demand for micro housing in Canada. It has presented key findings supporting the need for its adoption beginning with the demand, which was determined by identifying the lack of available housing inventory and the lack of affordability. This was presented in the housing statistics for two of Canada's largest cities (Vancouver and Toronto), highlighting their housing shortages and their challenges with maintaining affordability.

Next, the findings addressed the questions surrounding the population and its potential to impact housing demand now and in the future. Consumers were identified by age and generation providing results that indicated two generations (millennials and baby boomers) will hold the majority of buying power. These generations were discovered to be shifting current cultural norms from the desire to purchase large homes and accumulate an abundance of possessions, to a new trend toward smaller living spaces and minimalism.

The remaining findings responded to the potential sustainability of micro housing through its different applications as well as its economic, environmental and social sustainability perspectives. Applications such as micro apartments, small footprint homes and trailer-style semi-permanent tiny homes showcased how this alternative housing option could be customized for incorporation based on the potential location and its population demands. It further illustrated that the effects of reducing debt burdens, living with less and engaging more with community contributed to the potential for a happier population. Environmentally, the associated impacts of micro housing were also found to be significant due to the substantial reduction in energy consumption positively decreasing harmful emissions and carbon footprints.

It was also determined that the demand in Canada was not solely centered in metropolitan cities, however this research limited its scope to address two of the highest priced real estate markets in the country (Vancouver and Toronto). Further research into rural areas, native reservations and northern regions are recommended to assess the applicability of micro housing in these areas and to gain a more complete picture of the housing requirements across Canada.

The recommendations stemming from the findings calls for the incorporation of micro housing specifically in city centres to increase the supply of available rental properties that meet the definition of affordability (based on location). Further, micro housing developments can multiply the number of homes in sub-urban areas, and provide "*in-fill*" housing using semi-permanent transportable living quarters (tiny houses on wheels) throughout urban and rural areas. These options add to the housing market by stabilizing the quantity of available housing, rebalancing affordability (rental and

purchase pricing), and providing sustainable development alternatives to meet the needs of the future population.

To enable the implementation of micro housing, the analysis revealed the need to create new standards of livability at a national level. Moreover, the current regulations legislated by governments, cities and municipalities require revitalization surrounding the acceptance of smaller housing developments. By incorporating new standards, reassessing outdated zoning and by-law restrictions and adding alternative housing options, micro housing has the potential to transform the housing landscape.

Other considerations for research surrounding the application of micro housing are how micro housing can assist the senior population to “age in place”, how it can create student housing on University campuses and how its development can support the increasing Indigenous populations. There is also potential to research the use of micro housing to support Canadians designated as low-income earners as well as the homeless population.

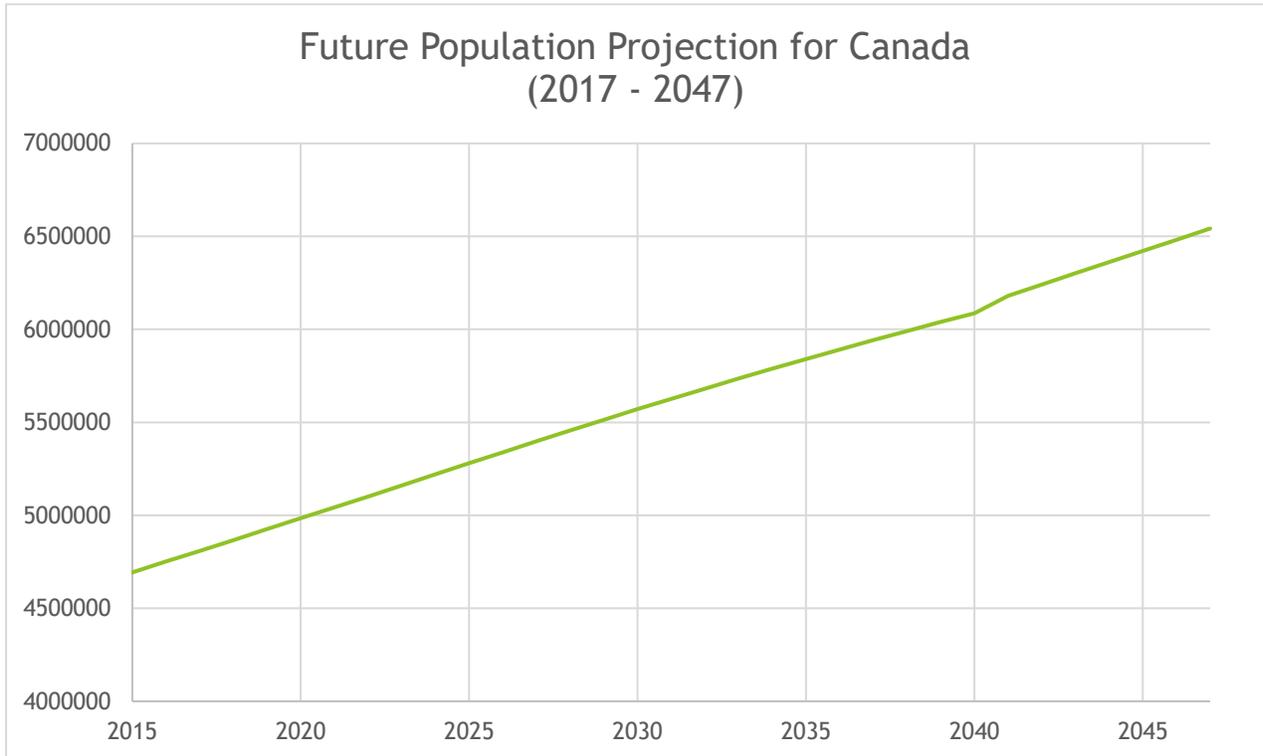
Broader questions surrounding advances in housing specific technologies and their application to micro housing are suggested as future research studies. New home technology applications are being developed at an increasing rate and can potentially advance the functionality of micro housing well beyond the applications discussed in this research paper.

Together, the findings, analysis and recommendations present micro housing as a solution to the identified issues being faced in Canada through housing affordability, population shifts, and future housing development. Micro housing merges creativity with livability, form with function and is evolving the landscape of the housing market. In conclusion, there is a demand for micro housing, and it is in Canada’s future to embrace it.

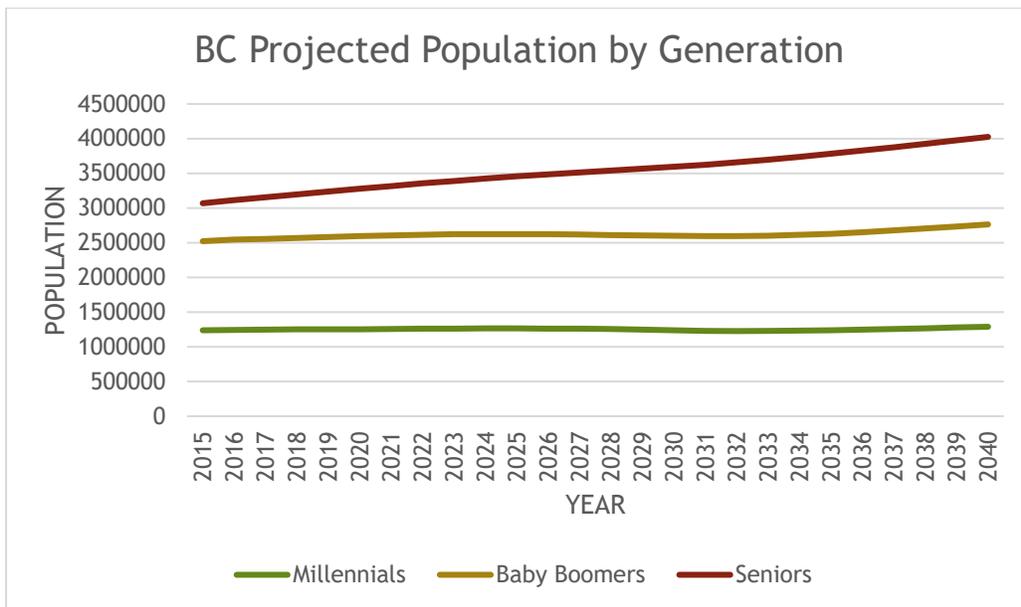
9. APPENDICES

APPENDIX 1: FUTURE POPULATION PROJECTIONS FOR CANADA, BC AND ON

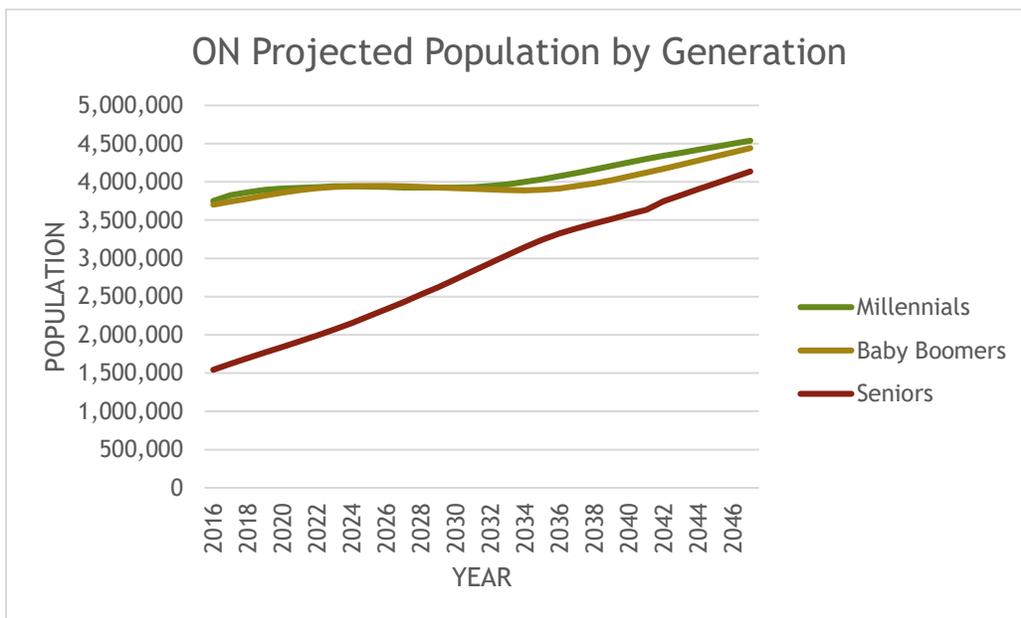
CANADA 2017 - 2047



BRITISH COLUMBIA



ONTARIO



APPENDIX 2: FUTURE POPULATION PROJECTION DATA FOR BRITISH COLUMBIA BY GENERATION

Year	Total	Millennials	Baby Boomers	Seniors
2015	4692953	1239071	1283135	547015
2016	4751612	1244873	1301247	568571
2017	4807794	1247446	1308596	598001
2018	4866947	1250683	1317788	626790
2019	4925605	1253117	1329460	654380
2020	4984489	1254278	1339989	683019
2021	5042891	1256036	1350623	711235
2022	5101602	1259651	1355850	739615
2023	5161017	1263266	1359024	768957
2024	5220483	1264736	1359618	799745
2025	5279860	1264123	1359489	832121
2026	5338966	1263002	1359023	864667
2027	5397681	1259711	1357839	897325
2028	5455974	1255020	1356103	930915
2029	5513707	1248359	1356921	963643
2030	5570623	1240266	1359122	997042
2031	5626295	1231683	1362695	1030650
2032	5681549	1227591	1368628	1062256
2033	5736258	1228641	1373393	1095355
2034	5789004	1232232	1380201	1126378
2035	5840585	1237773	1391639	1153509
2036	5891809	1246409	1406413	1176565
2037	5941962	1257023	1422753	1196895
2038	5991138	1267699	1439211	1217734
2039	6039418	1278427	1456275	1239778
2040	6086887	1289243	1474719	1261559

APPENDIX 3: POPULATION PROJECTION DATA FOR ONTARIO BY GENERATION

Year	Total	Millennials	Baby Boomers	Seniors
2016	13,982,984	3,750,780	3,702,079	1,542,863
2017	14,229,546	3,824,589	3,743,085	1,622,165
2018	14,438,974	3,865,440	3,781,440	1,697,967
2019	14,634,286	3,897,628	3,821,627	1,770,315
2020	14,814,956	3,914,618	3,859,455	1,842,940
2021	14,980,422	3,920,895	3,894,588	1,916,613
2022	15,147,203	3,930,721	3,918,314	1,991,430
2023	15,315,144	3,941,853	3,933,341	2,070,726
2024	15,483,879	3,944,634	3,941,099	2,154,824
2025	15,653,108	3,939,162	3,945,928	2,244,806
2026	15,822,463	3,932,602	3,947,924	2,335,274
2027	15,991,555	3,927,918	3,943,801	2,429,866
2028	16,160,021	3,925,573	3,935,800	2,527,123
2029	16,327,528	3,925,946	3,928,062	2,626,208
2030	16,493,788	3,926,712	3,919,207	2,729,642
2031	16,658,591	3,932,548	3,909,994	2,835,991
2032	16,821,835	3,946,648	3,902,552	2,938,833
2033	16,983,400	3,969,398	3,895,105	3,045,173
2034	17,143,258	4,000,322	3,889,996	3,148,826
2035	17,301,427	4,034,412	3,895,254	3,244,497
2036	17,458,005	4,075,092	3,915,318	3,325,191
2037	17,613,102	4,119,235	3,947,130	3,392,000
2038	17,766,884	4,165,327	3,982,144	3,454,652
2039	17,919,489	4,209,825	4,023,479	3,515,883
2040	18,071,073	4,255,796	4,072,336	3,575,249
2041	18,221,800	4,301,207	4,120,260	3,633,382
2042	18,587,851	4,340,621	4,172,468	3,748,600
2043	18,800,595	4,380,197	4,226,257	3,826,165
2044	19,013,339	4,419,772	4,280,047	3,903,729
2045	19,226,084	4,459,348	4,333,836	3,981,294
2046	19,438,828	4,498,923	4,387,626	4,058,859
2047	19,651,572	4,538,499	4,441,415	4,136,424

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11. GLOSSARY OF TERMS

Micro house	also known as a tiny house; a home built with living space of between 100 - 400 square feet; built on a trailer or foundation (Micro Showcase, 2015)
Affordability	where home owners pay no more than 30% of their total household income on shelter expenses (Statistics Canada, 2016)
Affordable housing	cost-effective housing that meets the needs of the potential home owners (financially viable consumers) (Quigley, 2016)
'The future'	defined as 2017 – 2047 with results investigated incrementally at 5-year intervals for this period
Demand	the need for housing for the population as it ages that is affordable and sufficient in size and location
In-fill housing	A term suggesting the use of land to be used for housing between existing buildings (Gravel, 2016)