SATELLITE CITIES OF THE TWENTIETH CENTURY: A SUSTAINABILITY ANALYSIS OF MILTON KEYNES AND RESTON

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Abstract

The population residing in urban areas has been rapidly increasing, especially in the developing world, giving rise to the need for cities and urban establishments to adapt and grow with the change. Satellite cities were developed in the 20th century to shift the population from congested urban areas to new developments established nearby. Milton Keynes in the United Kingdom and Reston in the United States are two New Towns of the 20th century developed to decongest a larger urban center. The paper assesses these two towns against sustainability standards of today, to explore the potential of this form of development as a sustainable tool for planners in the 21st century. It was found that while both towns are somewhat economically sustainable (self-contained with a high median household income), they are not sustainable environmentally (highly auto-dependent with poor air quality), and only slightly sustainable socially.

Chapter 1

Introduction

According to estimates by the United Nations, 66% of the world's population will be living in urban areas by 2050, upward from 54% today (United Nations, 2014). The rural to urban migration is not only adding a large number of new residents to cities but also putting pressure on the resources and infrastructure of these metropolitan areas.

As stated in the 101st Inter-Parliamentary Conference resolution (1999), some issues that hinder the sustainable growth and progress of metropolitan areas include:

- shortage and inadequate state of housing;
- environmental pollution;
- deterioration of building stock;
- inadequacy of infrastructures;
- high unemployment rate; and
- traffic congestion.

Additionally, as Kotter and Friesecke (2011) note, the influx of people into cities has environmental consequences that can adversely impact economic activity and public health. Increase in population density, socio-economic disparities and infrastructure problems arise that stress the need for sustainable city planning to result in the efficient running of cities (Chrysoulakis, de Castro & Moors, 2014).

Urban infill is one method of increasing capacity within a city, however, meeting the increasing

demand purely through this method is challenging and perhaps not at pace with the influx of people into the city. Heid (2004, p. 3) found that in three metropolitan areas in the US while infill development was successful, 'infill as a percentage of total area growth remains a minor portion of total growth'. Alternatives of infill development in order to accommodate growth in metropolitan areas is thus, necessary. Developing sustainable greenfield sites is one way of absorbing some of the pressure (Forsyth et al., 2016).

Satellite towns are one form of greenfield developments. The Oxford dictionary of Architecture define satellite towns as:

> "Towns that are self-contained and limited in size, built in the vicinity of a large town or city to house and employ those who would otherwise create a demand for expansion of the existing settlement, but dependent on the parent-city for population and major services."

The definition continues to state that satellite towns were influenced by Garden Cities and makes the distinctions between *consumer-satellites* that are essentially dormitory suburbs, and *production-satellites* that include the capacity for commercial, industrial and production facilities. The latter are also referred to as New Towns.

Satellite towns were initially developed as a tool to overcome congestion and overcrowding problems in large cities. With the number of megacities rising and mass urbanization around the globe underway, planners need to think of creative ways to accommodate people in a safe and sustainable manner. If designed and built efficiently by conforming to sustainable land use and environmental principles, the development of satellite cities can potentially alleviate the

issue of overcrowding in large cities without resulting in urban sprawl, as well as help reconnect nature with urban life.

The thesis, therefore, seeks to explore the potential of satellite cities as a sustainable tool of development for planners in the 21st century. This is done by looking into the cases of Milton Keynes in England and Reston in the United States to assess them against measures of sustainability as found in the 21st century. The research question for the thesis is given below:

- How do 20th century satellite towns measure up against today's standards of social, economic and environmental sustainability?

Research Design

The thesis will seek to explore the two cases of Milton Keynes, England and Reston, United States against sustainability standards of today. These cases were selected because they are two of the most well-known instances of satellite cities. The two towns were designed based on different population projections. Milton Keynes was intended to serve a population of about 250,000, whereas Reston was designed for 75,000 people. Both towns were intended to be low density and somewhat dependent upon automobiles.

The analysis of the towns is two-part. The first part assesses the original master plans of each of the two towns. The original plans are assessed to gauge the goals and objectives laid out for the town at its inception. The towns have been evaluated using a criterion adapted from a framework published by the American Planning Association (APA) in a document titled *Sustaining Places: Best Practices for Comprehensive Plans.* The framework provides standards to develop sustainable comprehensive plans.

The authors, Godschalk and Rouse (2015) note that the document provides a,

> "dynamic, democratic process through which communities plan to meet the needs of current and future generations without compromising the ecosystems upon which they depend by balancing social, economic, and environmental resources, incorporating resilience, and linking local actions to regional and global actions."

While the framework sets the bar very high for comprehensive plans, it has been used since it is reflective of the stricter standards in place today. However, since many of the indicators included in this framework, which has only been developed in recent years, are not applicable to plans developed in the twentieth century when some of these subjects like climate change and environmental sustainability were not being discussed as major issues affecting the planet, the framework has been adapted to include indicators that were more relevant back then. Furthermore, the scoring system has also been modified for simplicity.

The APA framework is divided into six principles, two processes and two attributes, each with a set of indicators to assess the plans of towns. This study modifies the framework to use five of the six principles in the APA framework. As mentioned above, only those indicators that are applicable to the 20th century New Towns were selected. The modified framework is attached in Appendix A. The scoring system of the framework assigns a score of 0, 1, or 2 based on the extent to which an indicator has been stressed in the plan, where 0 means no mention of an indicator, 1 means some mention and 2 means high mention of it.

The second part of the analysis measures the current conditions of the New Towns. Several sustainability frameworks were consulted for this part of the analysis. Since many of the indicators in the APA Sustaining Places framework are specific to master plans, other frameworks were consulted for this part of the analysis that are more suitable to assess the current conditions of cities. The indicators selected were adapted from a toolkit published by Sustainable Cities International in a paper titled *Indicators for Sustainability: How cities are monitoring and evaluating their success* in 2012. These indicators were selected since they are flexible, easy to understand and cover multiple sustainability goals. Additionally, the toolkit is derived from sustainability frameworks applied in various international cities. It is holistic in nature covering a broad range of sustainability indicators. Most sustainability frameworks assign social, economic and environmental sustainability as the three pillars of sustainability, which is why the indicators selected for assessment fall under these three categories.

The selected indicators are shown in Appendix B. Each indicator is measured against the national average. This has been done to maintain consistency in the comparison. Since this is not a comparison between the towns of Milton Keynes and Reston, there are slight differences between the indicators selected for the two towns, due to differences in information available.

As explained in this chapter, the thesis aims to assess two twentieth century satellite cities using sustainability indicators of the twenty first century, adapted from frameworks designed in recent years. The idea is to identify areas in which these New Towns perform well and those in which they perform poorly, in order to guide planners in designing and planning for satellite cities of the twenty first century.

Chapter 2

Literature Review

The Garden City

Satellite cities of the 20th century were influenced by the principles of the Garden City as introduced by Ebenezer Howard. Howard pushed the idea of building garden cities that were planned in advance, limited in size, and surrounded by a permanent belt of open space. As Hall (2014) explains, Garden Cities were designed to move people away from the slums and the smoke of industrial towns and into new, self-contained towns that were built in open countryside. The idea as explained in Howard's famous 'Three Magnets' diagram shown in Figure 1, was to combine the best of town and country in a new settlement. This meant merging the economic and social opportunities of the town with the fresh air and nature of the countryside.

Howard in his book titled *Garden Cities of To-morrow* (1902), proposed towns of 32,000 people living on 1,000 acres of land, surrounded by 5,000 acres of green belt, to be clustered around a parent city creating a conurbation. While Howard provided principles and even diagrams to illustrate his idea of Garden City, he noted that each plan would differ based on the specific realities of the site selected for the new settlement. The Garden City plan that he laid out, had a ring and radial pattern. The goals of Garden City were to be achieved by a combination of natural and economic factors; by offering higher wages through a variety of employment

opportunities, suited to persons of varying talents, in a healthier environment created by large open space around the town.

The Garden City was to be designed to be self-sufficient with adequate employment opportunities, a myriad of leisurely activities like a library, a museum and a theatre to name a few, a range of housing options, as well as other community facilities like hospitals and educational institutions. The radial layout meant that all facilities and neighborhoods were closely connected.

The concept of individual taste and preference was given great importance by Howard, and was to be reflected in the types of housing available, as well as employment opportunities. Merchants and farmers would also have the option to trade within the town or take their goods to other markets outside of Garden City. Industry would be located in the outer ring closer to transportation linkages to keep the town unpolluted and reduce transport distance so as to protect the roads from damage. The towns were to be locally managed and self-governed with services provided by the municipality or by the private sector, whichever was more efficient.

The ideas proposed by Howard spread around the world, manifesting in various ways ranging from dormitory suburbs to more utopian schemes that called for decongesting great cities and recolonizing the countryside. Hall (2014) notes how variants of the Garden City concepts were applied around the world by Howard's lieutenants in Britain, France, Germany and the United States. He also states that responses to the Garden City evolved as the focus of urban planning shifted and objectives of New Towns changed.

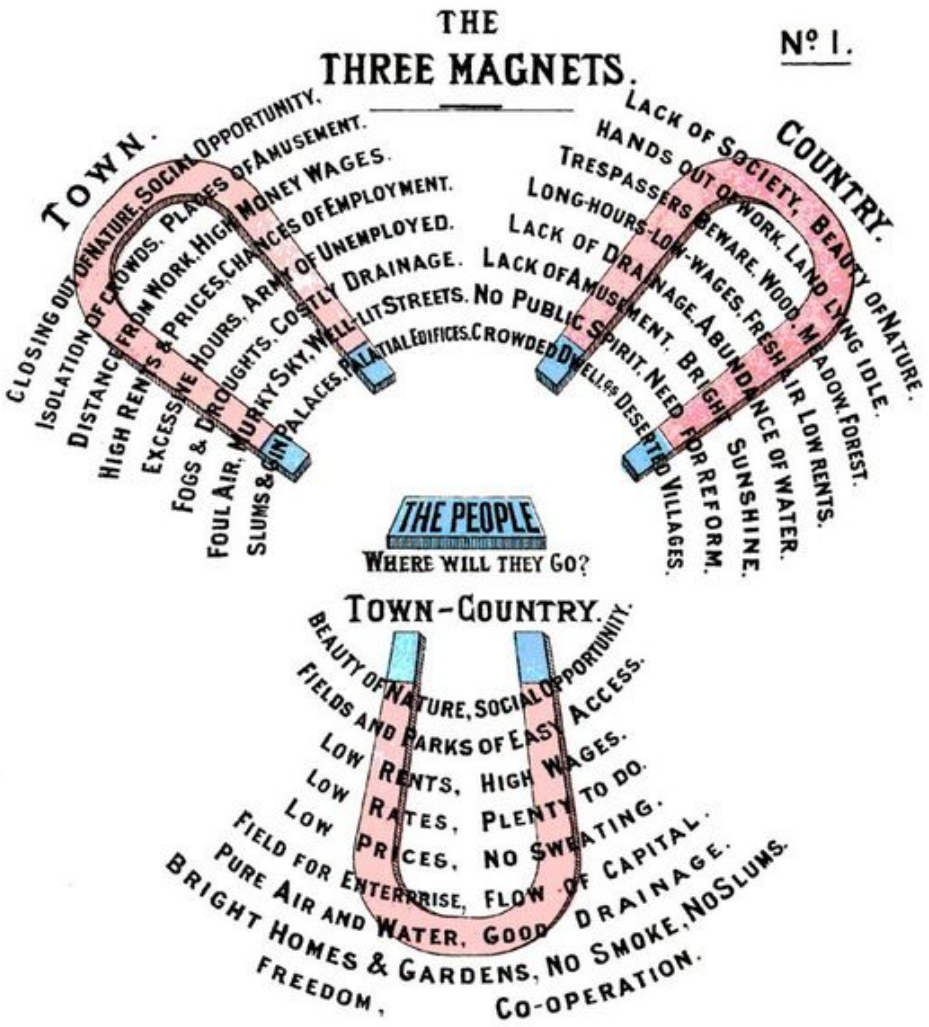

Figure 1: Ebenezer Howard's 'The Three Magnets' (Howard, 1902)

Changing Objectives of New Towns

The objectives behind developing New Towns have varied over the years as different themes and subjects gained more traction in the field of urban planning. In the first half of the 20th century, one of the dominant issues of planning was how to address the growth of very large metropolitan regions. Sorenson (2001) notes that the Greater London Plan of 1944 was an example of the ideology at the time to decentralize growth through the development of new

and expanded towns within the larger metropolitan region that were separated from London through green belts. Later in the 20th century the notion of urban form became an important factor as the concept of environmental sustainability emerged. Higher density forms were considered more sustainable since they allowed for more efficient operations of public transport, thus resulting in shorter trips and less dependency on automobiles. Newman & Kenworthy (1989) support this claim and associate higher density cities with lower gasoline consumption.

While there is not a widespread consensus on the most sustainable urban form, the model of 'decentralized concentration' is the most agreed upon to be a promising approach (Sorenson, 2001). This urban form constitutes nodes of concentrated mixed use that satisfy most needs of residents thus reducing the need for commuting to the central city. Further, the presence of public transit for longer trips would reduce the reliance on automobiles.

Similarly, there was a shift from the provision of good physical living conditions in the post-war New Town developments to an emphasis on social development and the provision of a variety of services and other opportunities in the New Towns developed post 1960s (Philips and Yeh, 1987). Perloff and Sandberg (1973) also note the changing image of New Towns through the 20th century from a utopian and visionary ideal, to a focus on physical design, to an instrument of regional planning, to an integrated social and economic phenomenon. This trend coincided with the heightened interest in environmental sustainabiliy in the late 20th century, as discussed in the next section.

Sustainability and its Indicators

Sustainable development is a term that was popularized in the 1980s with heightened environmental awareness (Haighton & Hunter, 2004). While there is no single definition of the term, the most widely cited albeit broad definition of sustainable development is provided by the Brundtland Commission (1987). It defines sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs.' Jenks (2000) describes sustainable development as 'development that does not require resources beyond its environmental capacity, is equitable, promotes social justice, and is created through inclusive decision-making procedures.'

Based on the two definitions given above, sustainability can be defined in economic, social and environmental terms. This is noted by Kates et al (2005) as well, who point out that sustainable development is a compromise between those who are concerned with nature and the environment, those valuing economic development and those dedicated to improving human conditions.

In the context of town planning, the question arises about indicators of sustainability. Astleithner et al (2004) write about sustainability indicators stating that they should be measurable over space and time. In a report published by Sustainable Cities International in 2012, the authors note that while there is no 'one size fits all' method for developing a sustainability plan for municipalities, there are common aspects that can be considered while designing a plan. A 2015 report titled 'Indicators for sustainable cities' published by the

European Commission discusses the available range of sustainability indicators and frameworks and how to choose between them.

The report states that while selecting an appropriate framework, the purpose for its use needs to first be defined. The framework can be used as an explanatory tool, pilot tool or performance assessment tool. The report also states that it is important to identify categories that are most relevant to measuring progress towards sustainable development. The categories, as delineated above, include social, economic and environmental sustainability. Social sustainability relates to subjects like community development, health equity, social justice and livability. Economic sustainability covers indicators that measure a nation's ability to support a certain level of economic production. Environmental sustainability covers topics that relate to a city's harmony with nature.

Furthermore, the framework should be applicable across different urban areas to allow for comparisons. Thus, the availability of data and its standardization should be taken into account when considering elements of the framework. Finally, the report notes that indicator sets should be locally relevant and be able to reflect the geographical and social context of the urban area in question.

Many states and municipalities have used sustainability frameworks to guide and monitor the sustainability objectives applied to their towns. While sustainability has become a bigger agenda in town planning and management post the 1980s, some of the objectives of 20th century satellite cities include self-containment of towns, providing a wide range of housing and creating towns that are in harmony with nature and protected from environmental pollution. These objectives are echoed in some of the social, economic and environmental sustainability

indicators included in the frameworks applied today. The next section highlights some of these indicators as apparent in satellite cities built in the last century.

Elements of sustainability in 20th century satellite cities

In the 20th century, Satellite Towns were introduced to reduce congestion in large urban centers by relocating people and jobs to the new developments (Philips and Yeh, 1987). In Britain, these new developments represented the ideas inherent in the original Garden Cities of Letchworth and Welwyn. They were intended to be limited in size and surrounded by open space. The towns were also intended to be self-contained through the provision of housing, employment and recreation to form a complete urban environment. Land uses in these towns, however, were separated and in some cases, social grouping in neighborhoods, based on income classes, was encouraged. Additionally, while some towns were built around a public transit network, others like Milton Keynes were designed to be dependent on car ownership. These towns, therefore, developed with a low density as noted by Davies (1972).

Philips and Yeh (1987) also note that self-containment has been a major objective of New Town developments, but they add that it has rarely been truly achieved. They posit that this is because self-containment has a multitude of dimensions, including balancing housing with employment, employment with skills of residents, housing with respect to different social groups as well as provision of services for all. If a balance is not achieved in any of these areas, the decision has to be made to connect the town with the central city through addequate transportation systems. This provision, further reduces the self-containment of the satellite towns as residents commute to the central city for better employment opportunities and social

activities.

Cervero (1995), however, notes that this may not necessarily be a bad thing. He writes about the New Towns of Stockholm that were developed in the mid 20th century in an orbit around the center of the city and connected via a regional rail system. He explains how planners intended to make these towns self-contained by distributing industry and offices proportionately with respect to the residential population of the towns. However, he found that these towns were relatively less self-contained, especially in comparison to the New Towns in UK. A large part of the population in Stockholm's New Towns, commutes daily to central Stockholm via the regional rail network. Cervero cites the example of Milton Keynes in the UK and notes that while the town is more self-contained in terms of jobs-housing balance, it is also more automobile dependent with one of the highest levels of vehicle kilometers travelled per capita in Europe. He thus states that self-containment of towns in terms of creating a job-housing balance is not a pre-requisite to promoting environmental sustainability.

The importance of public transit in achieving a sustainable city is highlighted by various authors. Newman and Kenworthy (1996) assess the land use-transport connection and the problems associated with unconnected automobile cities. According to them, the automobile dream turned into a nightmare when the easy access to individualized locations led to an exponential increase in traffic. They went on to outline the problems associated with such levels of automobile dependence stating severe environmental issues, economic inefficiency and lack of a community as some of the larger issues. They recommend transit-oriented development as one of the solutions to these issues.

Kaji et al., reaffirm this in a presentation prepared for the 2003 Open Meeting of the Global

Environmental Change Research Community in Montreal Canada in which they discuss the urban form, spatial characteristics and social functions that can lead to the development of sustainable compact cities. According to them, creating compact cities with a transit corridor save resources and energy and allows revitalization of the inner city. Merrilees, Miller and Herington (2011) note the importance of a mix of uses within a satellite city to allow residents to live and work in the same place.

Another theme, under social sustainability, is housing affordability, which is crucial for the development of healthy cities. Many New Towns of the 20th century were developed to provide more housing options to residents of congested cities. Singapore, through a process of trial and error, developed a model for New Towns to address the issue of housing shortage in the city-state, Field (1992) explains. The idea was to redistribute the population in order to relieve pressures of urbanization that lead to congestion and thus, hinder economic growth. Spatial parameters were designed by the Housing and Development Board of Singapore, to guide long-term development of a ring of satellite towns around a central area. The towns were developed to be self-contained with a mix of uses including light industrial, community centers, places of worship, open space and educational institutions. While the New Towns in Singapore are fairly self-contained, their smaller relative size when compared to other such settlements in the UK make them more interdependent amongst each other. Field explains how the policy to develop New Towns has been very successful in addressing the housing shortage in Singapore and alleviating issues of congestion and crowding.

Similar to Singapore, the New Towns of Stockholm were also developed in light of a housing crisis. Hall (2014) explains that the towns were developed around a public housing policy that

intended to create the 'largest state-controlled, more or less self-contained economic sector in any Western country'. The satellites cities were designed for a mix of housing types including single-family and multi-family residences. High-density apartment buildings for small-family and bachelor households were planned to be built closer to the rail stations, while medium-density terrace houses, villas and small cottages for larger families with children and those desiring more space were planned a little farther from the stations. In addition, tax incentives were provided to industries to lure them into the new towns and promote company-provided employee housing (Cervero, 1995).

Hall (2014) explains that in Sweden, between 1945 and mid-1970s, 45 percent of new housing was provided by public authorities. Legislation passed in the country during the mid 20th century established a right of first refusal of municipalities on all land sales. This led to housing being provided primarily by the local government, supplemented by cooperatives. Cervero (1998) notes that most of Stockholm residents live in multi-unit complexes and attributes that to a pro-active government that became involved in housing production at a time of rapid growth. The New Towns of Stockholm are thus examples of some of the more sustainable 20th century satellite settlements.

Another aspect of satellite cities that Merrilees, Miller and Herington (2011) discuss as being important to the success of towns is city branding. This is in line with a supporting category of sustainability – governance – as mentioned in some frameworks. The authors use the Sperling Stress Index indicators of unemployment rate, travel time to work, crime rate and divorce rate to develop a framework that studies stressed satellite cities. The results that were gathered through community surveys and analysis of the framework, indicate that residents identify a

number of factors as core brand attributes of cities. These include safety, nature, business opportunities, social bonds and government services. The authors noted that government can provide a supporting role to residents and help in the creation of business opportunities, and thus establish a socially and economically sustainable community.

The need for aligning sustainable policy goals with regional and national policies is also deemed important by various scholars. Philips and Yeh (1987) state that the plans for New Towns should be aligned with national goals of urbanization and serve as tools of regional policy. The objectives of these towns such as provision of housing should thus, be guided by the strategic objectives of the region such as accommodating growth. William et al. (2000) reaffirm this by noting the sustainable urban form can only be achieved if New Towns commit to global sustainability goals while allowing for more localized planning in terms of formation and implementation of solutions.

Chapter 3

A Closer Look at New Town Development: Part 1

Milton Keynes, England

Background

Milton Keynes is a new town located in Buckinghamshire, England. It was designated as a new town by the Minister of Housing in 1967, with the objective of relieving housing congestion in London. The plan for Milton Keynes was designed by consultants Llewelyn-Davies, Weeks, Forrestier-Walker and Bor (Milton Keynes Development Corporation, 1992). Milton Keynes was planned for 250,000 inhabitants – including existing population, incoming Londoners and expected future growth in population – on a land area of 22,000 acres (Davies, 1972).

Planning goals for Milton Keynes were devised over three months before design work on the plan began. They included the following:

a) Opportunity and freedom of choice,
b) Easy movement and access,
c) Balance and variety,
d) An attractive city,
e) Public awareness and participation, and
f) Efficient and imaginative use of resources.

All the decisions and policies laid out in the Master Plan for Milton Keynes follow these primary goals for the New Town. Six key structuring principles were defined to provide a framework to achieve these goals. These include designing a grid pattern of roads to disperse homes and jobs

around the town, thus resulting in an even distribution of traffic and avoiding rush hour congestion; a city center, or Central Milton Keynes (CMK) with a mix of uses; linear parks based on the valleys of rivers and streams; overlapping catchments containing homes that were not discrete and self-contained but part of the larger catchment area; activity centers, where shops, pubs, schools and bus stops were grouped, located at the cross-section of pedestrian routes with the mid-point of city roads so as to be accessible to pedestrians as well as automobiles; and pedestrian routes segregated from city roads in the form of underpasses or bridge crossings to provide safe and easy movement to pedestrians.

The next subsection includes an assessment of the original comprehensive plan of Milton Keynes based on sustainability indicators in the American Planning Association's report, 'Sustaining Places: Best Practices for Comprehensive Plans'.

Comprehensive Plan Assessment

The Master Plan for Milton Keynes scored 27 out of 58 points, or 47% on the framework (see Appendix C). The plan proposed a low-density city with discrete land uses widely dispersed within the town. The wide distribution would provide variety and freedom of choice to residents of the new town. While sites for industries were spread over the entire town, non-industry employment centers like health and education campuses were located away from the city center and treated like focal points that were major employment centers within themselves. In accordance with the low-density design, building height was limited to three-storeys with the exception of buildings located in CMK, where building height could extend up to six-storeys.

In keeping with the goal of freedom of choice, the transport policies were based on choice in mode of transport. The use of cars was not discouraged in the plan. Building a road system for cars was cheap and could be designed in stages as the travel needs of residents changed. Public transport was to be provided in the form of buses with frequent and rapid service. A grid network with employment diffused across it was adopted. The grid would be suitable for both cars and minibuses, thus serving the affluent, dependent on cars, as well as the less affluent who rely on public transport.

A continuous system of wide 'redways' was provided for pedestrians and cyclists. These are 3-meter-wide roads that are grade-separated and link with main activity points. The plan also acknowledged that with growth in the population and changes in technology, new systems of transport would be available in the future. Thus, some form of public transport, alternative to the bus, could potentially be applied at a later date.

The transport policies in Milton Keynes were designed keeping in mind the growing demand for automobiles. The consultants noted that the demographic of the New Town would have a preference for driving cars and number of vehicles per household was likely to increase from one to two over the long-term. The proposal for a monorail system in the town was rejected. However, pedestrian walkways and bike lanes were incorporated into the plan to allow greater freedom of choice to travelers and provide them with safer routes on the road network.

The section on housing included the objective to accommodate all income groups. In terms of home ownership, this meant reducing barriers to purchase a house in the town. In terms of renting a house, the objective was to make renting a home affordable to families with lower incomes. Rent rebate schemes were to be adopted, and their availability widely publicized.

In addition, while the plan intended for large areas of the city to not be segregated by class, it encouraged separation by income groups at a more local, neighborhood scale, suggesting that people from different income classes desire some level of segregation. In keeping with the objective of freedom of choice, a mix of housing by tenure and size was to be available across the city to allow people the choice between different neighborhoods and give them the ability to move from one area to another. Housing for individuals with special needs was to be integrated within residential areas and not provided exclusively in separate areas.

The section on health stresses the availability of quality healthcare throughout the town. It briefly mentions that the design of buildings, outdoor spaces and transport facilities should include suitable provisions for the physically handicapped.

Regarding housing densities, the need of the wealthy and more affluent families for more space and lower densities was recognized. While aligning private sector and public sector densities was an objective, building low density accommodations was not feasible for the public housing sector. Although the plan noted that the housing objectives did not allow for accentuating the discrepancy between the less and more affluent, the decision for determining housing density was left to 'consumer preferences, market trends and a longer-term view of the quality and adaptability of the housing stock.' This would lead to a gradual distinction in housing for different income groups. This suggests that attracting wealthier families to the town was a bigger objective of the plan than to promote integration between varying income groups.

With regard to employment, the plan had four objectives. These include creating a balanced growth of the labor force and industries, providing a wide range of choices for workers and for firms, providing vocational training and education to workers, and being consistent with

national, regional and local level objectives. The Master Plan aimed to create a job-housing balance so as to make the town self-contained and reduce the need for residents to commute to neighboring towns for employment. In stressing for a job-housing balance, the plan stated that the city, at all times, have as many jobs as there are individuals seeking jobs.

The section on employment also focuses on ensuring that opportunities are available to people from all groups and income classes. Thus, the role of training and education is stressed so that the skilled and technical jobs can become accessible to the relatively unskilled individuals as well. The plan adopts a long term focus of about three decades, and thus considers the need for physical expansion of businesses over time. Thus, firms coming in to set up base in Milton Keynes would have a variety of locations to select from with extensive space for expansion.

Additionally, the needs of women were also considered in the plan, since women were a growing part of the labor force. To facilitate working women, the plan suggested the distribution of employment in a diffused pattern around the city, with small-scale industry located within residential areas to allow women to work closer to home. The provision of day-care facilities was also suggested in the plan. Further, in the selection process of incoming firms into Milton Keynes, the gender ratio of a firm was going to be taken into account to ensure balance in the labor market for both genders.

With respect to environment and harmony with nature, the plan briefly mentioned the need for providing safe local roads for pedestrians and keeping volume of traffic in residential areas low to control noise and air pollution. It also stated that special attention would be paid to possible pollution of river water resulting from effluent discharge. Furthermore, the retention of woodland and trees is considered crucial to ensure their continuity into the future.

In the provision of adequate landscape and open space, the intention was to lay out a scenic town for the enjoyment of residents. The visual character was heavily stressed throughout the plan. A canal in the designated area for the town was considered an asset to be exploited by the locals for purposes including fishing, boating, canal-side walks and enjoyment of the scenery.

There was no explicit mention of mitigating crime, planning for a healthy lifestyle for citizens or providing equitable access to facilities. While the plan included the objective of providing jobs and housing for individuals from a variety of social and income classes, it did not mention affordability in the provision of other services like healthcare.

Key Takeaways

The plan for Milton Keynes pays good attention to some elements like ensuring a job-housing balance and providing a variety of housing types as well as employment opportunities, but it fails to address environmental as well as many social aspects like promoting environmental justice or providing equitable access to services and facilities. It should, however, be considered that the plan was designed before the concept of environmental sustainability gained popularity. The low score of the plan can be attributed to its lack of consideration to many social and environmental factors like safety of citizens, equitable access to facilities, planning for solid waste reduction and planning for post-disaster economic recovery.

Current Condition Assessment

The index below includes nine indicators to assess the current state of Milton Keynes. The indicators included in the current conditions framework can be broadly characterized into environmental, economic and social sustainability. The indicators for Milton Keynes are compared with the national average and also considered in isolation for the analysis.

On the environmental front, Milton Keynes produces lower CO_2 emissions than the UK. it does, however, have a higher share of automobile usage. The 13 percent commute undertaken by walking and cycling can be attributed to the redways designed in the original master plan that provides safe access to pedestrians and cyclists.

Recycling rate in Milton Keynes is slightly higher than that in the UK. However, the town also produces more solid waste per person than the rest of the country. Thus, in terms of environmental sustainability, Milton Keynes is in a better state than the rest of the country. However, in isolation the town is not very environmentally friendly, with a high dependence upon automobiles that has resulted in high levels of CO_2 emissions per capita.

In terms of economic sustainability, the town has a much higher median household income than the national average. The town also has a high unemployment rate, which is greater than that in the UK. Thus, while Milton Keynes does well on one indicator, it does very poorly on the other. This suggests that economic opportunities may not be equitably available to all residents. It should be noted that the original plan for Milton Keynes placed great emphasis on providing a variety of employment opportunities as well as training to workers. These original goals are not reflected in the current economic climate of the town. One of the reasons for this may be that the cost of living in the town has become too high to be sustainable.

Indicator	Milton Keynes	United Kingdom/ England
Transportation mode split	77% car, 8% mass transit, 13% walk & bike	64% car, 10% mass transit, 22% walk[1]
CO_2 emissions per capita[2]	6.8	7.1
Recycling Rate[2]	24.4%	21.9%
Volume of solid waste generated[2]	536 kg/head	433kg/head
Unemployment Rate	7.4%[3]	5.6%[4]
Median household income	£41,000[5]	£24,150[6]
Ratio of median house price to median earnings[7]	6.8	6.5
Life expectancy	76.2 male, 80.2 female[2]	79.5 – male 83.2 - female[8]
Child poverty	17.6%	18.6%

Table 1: Current Conditions Assessment of Milton Keynes

Additionally, as of 2013, the population of Milton Keynes stands at 255,700. This means that the town has exceeded 250,000 inhabitants – the number it was planned for. If the town continues to grow, this might pose a problem for its governance. This issue may need to be

[1] Milton Keynes Council. (2011). *A transport vision and strategy for Milton Keynes*. Retrieved from https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons

[2] Centre for cities. (2015). *Cities outlook 2015.* Retrieved from http://www.centreforcities.org/wp-content/uploads/2015/01/15-01-09-Cities-Outlook-2015.pdf

[3] Milton Keynes Council. (2016). *Local economic assessment 2016*. Retrieved from http://www.milton-keynes.gov.uk/business/local-economic-assessment-2016

[4] Office for National Statistics. (nd). *Unemployment rate (aged 16 and over, seasonally adjusted)*. Retrieved fromhttps://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/timeseries/mgsx/lms

[5] Milton Keynes Council. (2013). *Local profile.* Retrieved fromhttp://www.milton-keynes.gov.uk/business/milton-keynes-local-profile

[6] Office for National Statistics. (nd). *Housing disposable income and inequality: Financial year ending 2015.* Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/bulletins/householddisposableincomeandinequality/financialyearending2015

[7] Gov.uk. (2016). *Live tables of housing market and house prices.* (2016). Retrieved from https://www.gov.uk/government/statistical-data-sets/live-tables-on-housing-market-and-house-prices

[8] Office for National Statistics. (nd). *Life expectancy at birth and at age 65 by local areas in England and Wales:2012 to 2014.* Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/lifeexpectancyatbirthandatage65bylocalareasinenglandandwales/2015-11-04

addressed, perhaps through infill development of higher density, or through the creation of better linkages to neighboring towns for residents to find employment opportunities in.

With regard to social sustainability, the ratio of median house price to median earnings is also higher for Milton Keynes than that for the UK. This suggests that housing in Milton Keynes is less affordable than that in the UK. The life expectancy in Milton Keynes is also lower than that in the UK in general. This may be the result of a relatively less healthy and active lifestyle in Milton Keynes, than in the UK.

The percentage of children living under poverty in Milton Keynes in 2013 was equal to 17.6 percent, just below the England average of 18.6 percent. Children here are defined as the population below the age of 16, which constitutes 22.6 percent of the population of Milton Keynes. This is a large number for a town with a younger age profile than England. Thus, Milton Keynes is lacking in terms of social sustainability, in isolation or in comparison with national standards.

When compared with the national average, Milton Keynes does better on some indicators than others, especially in the case of environmental and economic factors. While the town recycles more than the national rate, it also adds more waste to the environment. Similarly, why the average earnings of the town are higher than the national average, the unemployment rate is much higher as well. For social factors, however, the town performs poorly on all indicators. Some of these results can be linked back to the policies laid out in the original Master Plan. For instance, automobile dependence is very high in Milton Keynes since the town was designed to be as such, and no incentives were provided to the residents to use alternative modes of travel. Additionally, environmental and social elements were largely neglected in the plan, and hence,

the town currently does poorly in these areas as indicated by housing affordability and child poverty. Some of the other factors like high unemployment are more difficult to explain, however, given the great significance given to the availability of employment opportunities in the original Master Plan. Based on the analysis of the Master Plan and current conditions of the town, Milton Keynes does not measure up very well against sustainability indicators of today.

Chapter 4

A Closer Look at New Town Development: Part 2

Reston, Virginia, USA

Background

Reston is a New Town located in Fairfax County, Virginia, United States. It is part of the Washington DC metropolitan area. The land, on which the town now stands, was purchased by Simon Enterprises in 1961. Robert E. Simon, who headed Simon Enterprises, had a vision for a country-city that would be a 'way' to live, rather than just a place to live. Simon, thus laid out a set of seven goals that would serve as a blue-print for the new town, which would be built on the 6,750 acres he had purchased (Linden, 1998). The goals are listed below.

1. Privacy and leisure - An environment of privacy as well as cultural and recreational facilities were to be provided in the new town to emphasize leisure time.
2. Permanence and heterogeneity - A wide variety of housing types was to be provided to cater to different income groups and family sizes, so as to allow residents to remain rooted in the community.
3. Individual dignity - The individual was to be given priority of larger scale concepts in the planning process.
4. Unity of life and work - A job-housing balance was to make the town self-contained.
5. Amenities provided from the start - Commercial and recreational facilities were to be provided to individuals from the beginning of development.

6. Natural and structural beauty - The natural and structural beauty of the town was to be enhanced to ensure a good quality of life.
7. Financial stability - The town was to be a financial success.

The Master Plan for the town was developed by Whittlesey and Conklin. The application of innovative land use was stressed by Simon to foster a well-balanced, integrated community. Simon, therefore, designed his own zoning code, which was adopted by the Fairfax County as the Residential Planned Community (RPC) zoning in June 1962 (A brief history of Reston, Virginia, 1973).

Comprehensive Plan Assessment

The Master Plan for Reston scored 22 out of 58 points, or 38% on the APA Sustainability Matrix (See Appendix D). The Master Plan for Reston was very different from that of Milton Keynes. The document was much shorter and less detailed. The plan laid out broad goals, and expected development to be guided as the market progressed, people moved in and more projections were made.

The Reston Master Plan laid out a town for 75,000 residents with seven village centers that would provide community and retail facilities to the 10,000 to 12,000 residents expected to reside there. A town center was to be linked to the seven villages and would serve the residents of Reston and additional visitors.

Housing types would include 80 percent of single-family detached homes, and 20 percent of multi-family homes in the form of townhouses, lake houses and hilltop houses. While the plan called for higher density houses in contrast to the low density character of old towns and

suburbs, the prescribed density for single family houses was 3.8 dwelling units per acre, and an average of 20 dwelling units per acre for multi-family housing. Since over 80 percent of the residential land was dedicated for single-family detached homes, the town was likely to be developed as low-density.

The houses were to be clustered together with maximum open area on the rear portions of the house. This would allow for wooded recreational space adjacent to the house. A portion of the higher density residential development was to be in high-rise buildings. The plan estimated that about 5.8% of the total population would be living in such developments. These would accommodate a wide range of income and age groups as well as the elderly.

The seven villages within the town would each have a village center, which would include shopping, community facilities, churches as well as housing. The higher density residential areas would form 'sinews of activity'. They were to be accompanied with walkways leading to local shopping centers and schools. These centers of activity would be accessible to every home in Reston by foot. The walkways could be used for walking or cycling.

Open space in Reston was to be accessible to all residents and used for recreational purposes instead of protection purposes. The plan prescribes ample open space in the form of parks, playgrounds, sports facilities and other recreational facilities. The total land area assigned for open space and recreational use would add up to 20 acres per 1,000 persons, far exceeding the 9.7 acres per 1,000 standard of The National Recreation Association. While the plan did not explicitly promote a healthy lifestyle it did encourage walking and cycling, and also facilitated pedestrians and cyclists through the creation of walkways and activity centers that could be reached by foot.

The plan allotted 17 percent of the total land in Reston for the development of employment centers that include industry and government. Based on economic reports, the employment generated would be able to serve most of the residents of Reston. The areas reserved for employment were mostly situated on the western end of the site, where the land was flatter and the soil less suitable for residential development. While the plan aimed to achieve a job-housing balance, a commuting strategy to provide residents access to the industrial employment centers was not discussed.

The plan aimed to attract light manufacturing and other industries like printing and publishing, and research and development, that were expanding into the Washington DC metropolitan area. The industries were to be grouped into industrial parks. The town center, mentioned earlier was intended to include office building and retail facilities, and would serve the residents of Reston as well as residents of nearby areas. Area in the town center was also reserved for other non-commercial uses, like an auditorium, a regional library, a museum and meeting rooms for conferences and other social gatherings.

With respect to medical facilities, the plan mentioned allocating space for an inclusive medical center. What constitutes inclusive was not specified, however. The plan stated that as the population of Reston and its neighboring areas would grow, detailed plans for a voluntary hospital, nursing and home care, as well as training facilities would be developed. Space was also allocated for a Public Health Center and other health facilities, to be developed at a later stage.

The plan noted that social and cultural organizations would advance based on the preferences of residents, but an effort was made to plan for such facilities, so as to allow them to evolve at

the earliest time possible. In doing so, the community facilities planned for each neighborhood included day-care centers, baby clinics, special housing and day centers for the elderly, places of worship, as well as other community facilities for residents.

With regard to utilities, preliminary plans for water supply, sewerage and storm drainage were included. The plan discussed the water sources available and the requirements of the town based on land use densities and notes the lines that will need to be added to provide adequate water supply. Similarly, in the case of sanitary sewers, the plan mentioned the sewer lines that are being constructed to serve the town. The section only stated that adequate capacity exists for utilities but included no mention of water conservation or the growth of infrastructure with trends in growth of the town.

The plan noted that the natural forest, ground cover, streams and stream valleys would be preserved and left in their natural state. Storm water runoff would be controlled through lakes, retention basins and temporary siltation basins. In addition to the flood plain, the plan also called for the preservation of other natural conditions. The town of Reston pledged their cooperation in an agreement with the Soil Conservation Service to control erosion and runoff in the town.

On the transportation front, the plan detailed the highways and road network that would be extended into the town. It also discussed a rapid transit line to Washington under consideration by the National Capital Planning Commission. If it were constructed, Reston was to have its own station, that the residents would be able to access through automobiles or bus service. The plan also mentioned the provision of generous parking spaces for automobiles in the village centers, suggesting that automobiles were not going to be strongly discouraged in the town.

The master plan anticipated that the growth of Reston would depend upon the growth of the region, marketing policies of the developer and changes in transportation systems of the region. It did anticipate the population to grow to 30,000 by 1970 and 75,000 by 1980.

Key Takeaways

The plan in general was not very detailed and included more goals and aims for the town rather than concrete objectives on how to achieve those goals. The plan allocated ample area for employment centers and commercial as well as non-commercial activities, thus providing room for economic growth. The plan mentioned provision of inclusive medical facilities as well as housing for all income groups, but no specific criterion was presented as to how low-income or minority groups will be accommodated. The needs of vulnerable and minority groups were not accounted for in the plan.

The plan did emphasize the development of mixed uses, which was a new concept in the 1960s. The recreational facilities were to be interwoven with residential areas and village centers would provide different services to residents within walking distance. The availability of ample open space, parks and sports facilities was also stressed in the plan. Conservation and preservation of floodplains and natural habitat was also stressed in the plan. The low score for the plan can be attributed to lesser consideration to social indicators like planning for the health and safety of vulnerable populations, economic indicators like planning for workforce development and environmental indicators like encouraging water conservation in the town.

Current Condition Assessment

The Reston current conditions index includes some indicators that are different from those in the Milton Keynes index, owing to differences in the availability of information. However, like Milton Keynes, these are also based upon environmental, economic and social sustainability, and are compared with national averages.

With regard to environmental sustainability, Reston does not score very well. Its air and water quality are both worse than that of the USA. These are based on measures produced by the Environmental Protection Agency (EPA). Both air quality and water quality are scored out of 100, with a higher score being better. Water quality refers to watershed quality.

In terms of mode of transportation, Reston is slightly less dependent on cars than the rest of the country. However, if taken in isolation, such high level of automobile usage is harmful to the environment and leads to higher levels of greenhouse gas emissions. The high level of car usage can also be attributed to the absence of a public transport strategy in the original master plan. While the original goals of the town promoted walkability, they were not realized as intended. Only 2.8% of commute is undertaken by walking and the percentage of bicycling is negligible.

While information on the share of energy from renewable sources in Reston was not available, the 2013 Reston Plan Amendment promotes energy conservation through the use of wind turbines as an energy source. In addition, green infrastructure in the form of green and cool roof systems, and radiant floor heating and cooling is also included in the amendment (Fairfax County, 2013).

Indicator	Reston	USA
Air quality[9]	45	58.4 (US)
Water Quality[10]	40	55 (US)
Transportation mode split (to work)[10]	Car - 80.2%, Mass transit - 7.4%, Walking - 2.1%	Car - 85.9%, Mass transit - 5.1%, Walk - 2.8%
Average commute time to work[11]	28.8 mins	25.9 mins
Unemployment Rate[10]	3.2%	5.2%
Median household Income[11]	$110,401 (ACS)	$53,889
Percentage of people living below poverty level[11]	7.3% (ACS)	15.5%
Crime rate[10]	Violent crime - 35.6 Property crime - 40	Violent crime - 31.1 Property crime - 38.1
Rent burdened population[11,12]	35.5%	51.8%
Percentage of population with health insurance[11]	72.4%	66.6%

Table 2: Current Conditions Assessment of Virginia

On the economic front, Reston is performing slightly better than the United States. This is reflective in the lower unemployment rate, as well as higher median household income. Additionally, the percentage of population living below poverty level in Reston is also lower than that in the country.[13]

Reston has a higher crime rate than the national average. In terms of housing, 35.5% of the rent-paying population is rent-burdened. While this is lower than the national value, it indicates inadequate housing in the town. The original master plan did not stress the provision of

[9] Reston, Virginia. (2017). *Sperling's best places.* Retrieved from http://www.bestplaces.net/health/city/virginia/reston
[10] 2015 ACS 5-year estimate
[11] As a percentage of renter households – (39.2% for Reston, 36.1% for the US).
[12] If a household spends more than 30% of its income on rent, it is considered rent burdened.
[13] These are the 2015 ACS 5-year estimates of population living under poverty for the past 12 months.

affordable housing. Reston, currently also has a housing shortage with a homeowner vacancy rate of 1.6 and rental vacancy rate of 3.6.[14] In the 2013 Comprehensive Plan Amendment, the town has stressed upon the importance of providing affordable housing and has set forth objectives for new developments as well as redevelopments, to ensure the creation of more affordable housing.

Furthermore, with regard to health insurance, while a greater percentage of the population has access to it in Reston, it should be noted that almost 28% of the town does not. This is a large part of the population that might be vulnerable and marginalized. In terms of social sustainability, while Reston seems to be doing well when compared with national standards, there is much room for improvement in order to create a town that is equitable and provides opportunities for all.

To summarize, Reston does not measure up very well against the national average with regard to environmental sustainability, but performs better in terms of economic and social sustainability. The Master Plan for Reston, however, was lacking in all three areas. It can be noted that the plan allowed for more flexibility in the development of the city and only prescribed broad goals and policies rather than specific objectives. The better performance of the town today may be a result of the flexibility in growth that was permitted by the nature of the plan.

[14] Vacancy rates lower than 5% indicate a housing shortage.

Chapter 5

Discussion

The two-part analysis of Milton Keynes and Reston shows that the two New Towns do not measure very well against the stringent sustainability indicators of today. There were some similarities observed in the planning of the two towns. While the Master Plan for Milton Keynes was much more detailed and covered many different elements in depth, both plans had some overlap. Both plans stressed creating a self-contained town with a variety of uses and services, including adequate employment opportunities, housing, retail services as well as cultural facilities. Creating a job-housing balance was emphasized in both plans to allow residents to live and work in the same place. Furthermore, the provision of large open space, accessible to all, was also largely emphasized in both plans.

While both towns were designed to be largely auto-dependent, Milton Keynes implemented a bus network as an alternative to the car. Both town plans encouraged walking and biking and provided safe access for pedestrians and cyclists. Other than the provision of an alternative mode of travel in Milton Keynes, there were also some other aspects in which the two town plans varied. The aspect of freedom of choice was heavily stressed in Milton Keynes, being one of the towns primary goals. The theme of freedom of choice was underscored in Garden City as well. Farmers had the choice of trading within Garden City or exploring other markets, which was made possible by a rail network around the Garden City. In addition, variety in architecture and design of housing was allowed to encouraged individual tastes and preferences. Similarly in

Milton Keynes, it was considered very important to provide a variety of housing types as well as employment opportunities to residents to allow them that freedom.

Training and workforce development was also a major element in the Milton Keynes plan, which was absent in the Reston Plan. The Reston plan, on the other hand, attempted to differentiate between the New Town and other American suburban towns, by encouraging a mix of uses and experimenting with higher densities, albeit at a very small scale. The Reston plan also included mention of preservation and conservation of soil, floodplain and forests, which was absent from the Milton Keynes plan.

When looking at more current conditions, it can be noted that Reston performs better when compared with its national average. Both towns perform somewhat better in terms of environmental and economic sustainability than social sustainability. Affordability of housing, for instance, is an issue in both towns. Satellite towns were originally developed not only to decongest large urban centers but also to provide a more affordable lifestyle by offering housing away from urban centers where prices would be lower. For Garden City, Howard postulated that rents would be tied to the annual value of the land. Today, tools like inclusionary zoning can be used to try and develop more affordable housing so as to address the needs of all segments of the population.

Furthermore, since the issue today is that of rapid urbanization and accommodating a large influx of people, building low density satellite cities may not be feasible. Howard suggested that growth should be accommodated using a cluster of New Towns, once the population of these New Towns reached the prescribed higher limit. This meant developing another New Town at some distance from the existing one to form satellites around the central urban core. This

would be done to avoid developing on the open space around each New Town and maintaining the town-country model. However, this method may not always be feasible today, especially in the developing world where the large growth in urban population is occurring, due to limitations in land availability. Therefore, it may be more suitable and sustainable to build at higher densities to accommodate a larger number of people and provide adequate housing, so as to avoid the housing shortage experienced by Reston today.

Milton Keynes and Reston today are also highly auto-dependent. This can be tied back to the policies laid out in their Master Plans, which encouraged this dependency on housing. It should be noted that these policies were in contrast to walkability model suggested by Howard, who proposed towns where distances between key destinations and residential areas were kept to a minimum and the cluster of New Towns, as well as the central urban city were connected via a rail network. While both towns included the provision of bike and pedestrian routes in their plans, the current modal share does not reflect a high usage of the modes. The decision to walk or bike around towns is affected by many different factors around the world. In some countries, extreme climate may not allow it, while in others the culture of society may inhibit women from doing so. While these factors need to be considered by planners when designing new towns, they cannot be changed by them. One thing that can be controlled, however, is the way the city is laid out, to reduce distance between key locations.

Today, both the towns realize the negative impacts of automobiles on the environment, and in their updated comprehensive plans have included the objective of providing or improving alternative modes of transport to reduce the dependence on automobiles. It is, however,

challenging to lay out large-scale infrastructure in a built city. Therefore, it is crucial to make these decisions during the planning stages.

Milton Keynes and Reston, both are lacking when it comes to environmental sustainability. This is reflective in their original Master Plans, in which much consideration is not given to environmental factors, although, it should be noted that the negative effects of development on the environment were not well-known when these towns were designed. In their current conditions the towns again do not perform well when looking at pollution levels, recycling rates and automobile usage. Both towns do perform slightly better than their national average in some indicators and, in their recent plan amendments, have incorporated elements of conservation, reducing pollution and developing more green infrastructure to gear the towns towards a more sustainable track.

The needs of minority and vulnerable populations and equitable access to healthcare, housing, employment and transportation are other elements that were largely neglected by both towns in their Master Plans, and this is reflected in the low social sustainability in their current conditions. The Office of National Statistics provided ethnicity demographics for Milton Keynes according to which over 30% of the population in the town is non-white. Minority groups can often become marginalized; towns should attempt to address the different needs of different groups. Protecting vulnerable populations, addressing their needs and providing equitable access are ways towns can be more socially sustainable.

Satellite developments in the 21st century can learn lessons from these New Towns. The analysis of Milton Keynes and Reston shows that major infrastructure decisions made during the planning phase affect the long-term physical patterns in the city. For greenfield

developments, towns have a blank slate to work with. Thus, it is more cost-effective to lay down heavy infrastructure, like a mass transit system, at that stage, rather than trying to accommodate it at a later stage, when new development presents new constraints.

Furthermore, by setting goals at inception that are in line with measures of sustainability and equity, New Towns can develop as efficient cities that cater to the needs of all residents without harming the environment. Both towns were developed in line with the primary goals that were set out at inception. The towns were intended to be self-contained, and laid out objective to achieve that goal. A job-housing balance was created and other commercial and community institutions were also provided, which led to both towns developing as self-contained cities. Furthermore, one of Reston's goals was to be financially sustainable, and today it is performing much better in terms of economic indicators than the national average. The original goals of Milton Keynes and Reston suggest that these satellite cities were not built for sustainability. However, by virtue of being small-scale greenfield developments, such new settlements present an opportunity for sustainable development where green and equitable practices can be piloted. Thus, by envisioning a sustainable future for a new town and designing goals and objective in line with that vision, a sustainable city can be realized.

Limitations

The research was limited by the availability of information. Data on certain indicators was not available for the towns, which is why they had to be excluded from the analysis, for instance, recycling rates for Reston. Furthermore, the most current information on the New Towns was also not available for certain indicators. For the current scenario analysis, information on all the

indicators was not available for the same year. Most recent figures have been included. For Milton Keynes, some of the indicators had to be compared with UK, while others were compared to England, depending upon availability of information.

Another limitation for the study was that the impact of policies on individual indicators could not be isolated from impacts of state or national policies. For instance, indicators like unemployment rates can be affected by the national as well as local economy. Thus, the impact of solely the local plans and policies on indicators is difficult to quantify.

Future research

This thesis attempted to assess two New Towns of the 20th century against sustainability measures of the 21st century. Future research can be geared towards analyzing other New Towns, perhaps those that fall under a different typology. Several different typologies of satellite cities have manifested in different parts of the world.

In the city states of Hong Kong and Singapore, new towns were developed to provide land for massive public housing programmes in order to relieve population pressures that arose with rapid post-war industrialization and economic growth. Thus, the provision of public housing was at the forefront of new town development in these city-states (Philips and Yeh, 1987).

The New Towns of Stockholm, Sweden, were developed with rail linkages to the central city. Thus, while these towns are not as self-contained as the two discussed in this thesis, they are more environmentally sustainable. Other typologies include innovation districts or science cities, like Tsukuba City in Japan.

In addition to studying other types of satellite cities, the research can also be expanded by elaborating the sustainability framework and indicators used to assess the towns. More qualitative analysis, for instance, assessing the impact of high versus low density development can also be performed to compare satellite cities. The APA sustaining places matrix can also be applied to the most recent master plan of the town for further analysis.

Appendix A

Modified APA Framework

Sustainability indicators to assess the New Town comprehensive plans.

1. Plan for multimodal transportation.
2. Plan for transit-oriented development.
3. Provide complete streets serving multiple functions.
4. Plan for mixed land-use patterns that are walkable and bikeable.
5. Provide accessible public facilities and spaces.
6. Implement green building design and energy conservation.
7. Discourage development in hazard zones.
8. Restore, connect, and protect natural habitats and sensitive lands.
9. Plan for the provision and protection of green infrastructure.
10. Encourage development that respects natural topography.
11. Enact policies to reduce carbon footprints.
12. Encourage climate change adaptation.
13. Provide for renewable energy use.
14. Provide for solid waste reduction.
15. Encourage water conservation and plan for a lasting water supply.
16. Protect and manage streams, watersheds, and floodplains.
17. Provide the physical capacity for economic growth.
18. Plan for a balanced land-use mix for fiscal sustainability.
19. Plan for transportation access to employment centers.
20. Promote green businesses and jobs.
21. Provide and maintain infrastructure capacity in line with growth or decline demands.
22. Plan for post-disaster economic recovery.
23. Provide a range of housing types.
24. Plan for a jobs-housing balance.
25. Plan for the physical, environmental, and economic improvement of at-risk, distressed, and disadvantaged neighborhoods.
26. Plan for improved health and safety for at-risk populations.
27. Provide accessible, quality public services, facilities, and health care to minority and low-income populations.
28. Plan for workforce diversity and development.
29. Protect vulnerable populations from natural hazards.

30. Promote environmental justice.
31. Reduce exposure to toxins and pollutants in the natural and built environments.
32. Plan for increased public safety through the reduction of crime and injuries.
33. Plan for physical activity and healthy lifestyles.
34. Provide accessible parks, recreation facilities, greenways, and open space near all neighborhoods.
35. Plan for access to healthy, locally grown foods for all neighborhoods.
36. Plan for equitable access to health care providers, schools, public safety facilities, and arts and cultural facilities.

Appendix B

Sustainability indicators to assess current conditions of New Towns

1. CO_2 emissions per capita
2. Air quality
3. Water Quality
4. Transportation mode split
5. Average commute time to work
6. Recycling Rate
7. Volume of solid waste generated
8. Unemployment Rate
9. Percentage of population living under poverty levels
10. Median Household Income
11. Crime rate
12. Percentage of rent burdened population
13. Ratio of median house price to median earnings
14. Life expectancy
15. Percentage of population with access to health insurance.

Appendix C

Milton Keynes comprehensive plan assessment.

Milton Keynes	Score			
Indicator	0	1	2	Source (e.g. page, chapter, table, etc. in plan)
Plan for multimodal transportation.		1		The Plan for Milton Keynes, Volume 2, page 286
Plan for transit-oriented development.	0			
Provide complete streets serving multiple functions.		1		The Plan for Milton Keynes, Volume 2, page 279
Plan for mixed land-use patterns that are walkable and bikeable.		1		The Plan for Milton Keynes, Volume 2, page 279
Provide accessible public facilities and spaces.			2	The Plan for Milton Keynes, Volume 1, page 62
Restore, connect, and protect natural habitats and sensitive lands.			2	The Plan for Milton Keynes, Volume 2, page 325-326
Encourage development that respects natural topography.		1		The Plan for Milton Keynes, Volume 2, page 309
Provide for solid waste reduction.	0			
Encourage water conservation and plan for a lasting water supply.		1		The Plan for Milton Keynes, Volume 2, page 340-242, 344-345
Protect and manage streams, watersheds, and floodplains.		1		The Plan for Milton Keynes, Volume 2, page 326
Provide the physical capacity for economic growth.			2	The Plan for Milton Keynes, Volume 1, page 50
Plan for a balanced land-use mix for fiscal sustainability.		1		The Plan for Milton Keynes, Volume 2, page 147-148
Plan for transportation access to employment centers.		1		The Plan for Milton Keynes, Volume 1, page 33
Provide and maintain infrastructure capacity in line with growth or decline demands.		1		The Plan for Milton Keynes, Volume 2, page 337
Plan for post-disaster economic recovery.	0			
Provide a range of housing types.			2	The Plan for Milton Keynes, Volume 2, page 189
Plan for a jobs-housing balance.			2	The Plan for Milton Keynes, Volume 1, page 51
Plan for the physical, environmental, and economic improvement of at-risk, distressed, and disadvantaged neighborhoods.	0			
Plan for improved health and safety for at-risk populations.	0			

Provide accessible, quality public services, facilities, and health care to minority and low-income populations.	0			
Plan for workforce diversity and development.			2	The Plan for Milton Keynes, Volume 2, page 148
Protect vulnerable populations from natural hazards.	0			
Promote environmental justice.	0			
Reduce exposure to toxins and pollutants in the natural and built environments.			2	The Plan for Milton Keynes, Volume 2, page 304, 339
Plan for increased public safety through the reduction of crime and injuries.		1		The Plan for Milton Keynes, Volume 2, page 303, 304
Plan for physical activity and healthy lifestyles.	0			
Provide accessible parks, recreation facilities, greenways, and open space near all neighborhoods.			2	The Plan for Milton Keynes, Volume 2, page 324
Plan for access to healthy, locally grown foods for all neighborhoods.	0			
Plan for equitable access to health care providers, schools, public safety facilities, and arts and cultural facilities.	0			

Appendix D

Reston comprehensive plan assessment.

Reston	Score			
Indicator	0	1	2	Source (e.g. page, chapter, table, etc. in plan)
Plan for multimodal transportation.		1		Reston Master Plan pages 17-18
Plan for transit-oriented development.	0			
Provide complete streets serving multiple functions.		1		Reston Master Plan pages 5-6
Plan for mixed land-use patterns that are walkable and bikeable.			2	Reston Master Plan pages 5, 6, 8
Provide accessible public facilities and spaces.		1		Reston Master Plan pages 8, 10, 11
Restore, connect, and protect natural habitats and sensitive lands.		1		Reston Master Plan page 16
Encourage development that respects natural topography.			2	Reston Master Plan pages 8, 11
Provide for solid waste reduction.	0			
Encourage water conservation and plan for a lasting water supply.	0			
Protect and manage streams, watersheds, and floodplains.			2	Reston Master Plan page 16
Provide the physical capacity for economic growth.		1		Reston Master Plan page 8
Plan for a balanced land-use mix for fiscal sustainability.			2	Reston Master Plan page 8
Plan for transportation access to employment centers.		1		Reston Master Plan page 17
Provide and maintain infrastructure capacity in line with growth or decline demands.	0			
Plan for post-disaster economic recovery.	0			
Provide a range of housing types.			2	Reston Master Plan page 5
Plan for a jobs-housing balance.			2	Reston Master Plan page 11
Plan for the physical, environmental, and economic improvement of at-risk, distressed, and disadvantaged neighborhoods.	0			
Plan for improved health and safety for at-risk populations.	0			

Provide accessible, quality public services, facilities, and health care to minority and low-income populations.		1		Reston Master Plan pages 10, 13
Plan for workforce diversity and development.	0			
Protect vulnerable populations from natural hazards.	0			
Promote environmental justice.	0			
Reduce exposure to toxins and pollutants in the natural and built environments.	0			
Plan for increased public safety through the reduction of crime and injuries.	0			
Plan for physical activity and healthy lifestyles.		1		Reston Master Plan pages 5, 10
Provide accessible parks, recreation facilities, greenways, and open space near all neighborhoods.			2	Reston Master Plan pages 8, 10
Plan for access to healthy, locally grown foods for all neighborhoods.	0			
Plan for equitable access to health care providers, schools, public safety facilities, and arts and cultural facilities.	0			

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