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Compact City: A Comparative Study of Urban Policies

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Abstract

After urban sprawl was revealed as an undesirable phenomenon of urbanization due to its physical, economic and social negativities, various urban models have been introduced to minimize the damages of urban sprawl. One of the most significant examples of these city models is “compact city”. Although many countries in the world have not adopted the compact city model yet, there are countries which have taken successful steps in this regard. In this context, the current research has suggested a theoretical framework to define compact city with its chief indicators. Later, four significant cities in terms of urban compaction are chosen as case studies from diverse parts of the world. A comparative assessment method was applied to find similarities and differences among the case studies in terms of compact city interventions. In the light of compact city indicators cited in literature, the present study aims to reveal what kind of planning policies should be adopted and what steps can be taken to achieve a successful compact city model. The result of the study clarifies the common characteristics of cities that are successful in terms of urban compactness.

Keywords: Compact city, density, mixed-use, urban sprawl, urban compactness policy

INTRODUCTION

Although urbanization is substantially considered as a positive urban development, when it exceeds a certain rate, it can bring many negativities with it. For this reason, in the field of urban studies, still proposals and debates for a city model that can establish a correct balance between urbanization and its negative consequences continues. Various studies measuring the rate of urbanization in the world over the years show that the urbanization rate, which was 34% in the world in the 1960s and 54% today, will increase day by day and reach 66% in 2050 (Organization, World Health, 2014). The least desired dimension of urban growth in the last half century has been the "urban sprawl" which shows significant differences and reasons according to cities and countries. Urban sprawl is defined as dispersed and low-density urban development (Ismael, 2021). Inefficient crowding on the roads, high levels of car air pollution in metropolitan areas, loss of open space facilities, decreased social interactions (Sakamoto et al., 2018) and unequal provision of public goods and services in neighborhoods leading to discrimination are some of the major issues raising concerns about urban sprawl (Rubiera-Morollón and Garrido-Yserte, 2020). Many researchers in diverse fields as well as urban studies are searching solutions to decrease damages caused by urban sprawl. Principally, in recent decades accomplishing urban sustainability has become a chief objective for urban planners. Among diverse aspects of urban sustainability, environmental protection particularly green land conservations are very significant for most of the cities. In search of more sustainable city models the "compact city" model has been put forward by many urban planners as a city

model that can solve the problems caused by urban sprawl due to high density and keeping urban development within restricted borders (Abdullahi and Pradhan, 2018). The requirement to manage urban sprawl and its multiple opposing consequences by encouraging compact urban development and increased urban density has come to agenda in urban studies as well as policy-making processes (Artmann et al., 2019). There are a wide range of researches which have measured and studied urban compactness issue from different perspectives. Although compact city model has not yet been adopted by most countries in the world as a city planning policy, some countries have taken significant steps that can be successful in this regard and be example for other cities. While there are a considerable number of studies handling compact city concept from diverse perspectives, there is a significant requirement in terms of analyzing issue through successful implemented examples. Therefore, this study aims to find out similarities and successful aspects of cities which has taken successful steps in terms of controlling urban sprawl and enhancing urban compactness in order to extract policies which can be implementable for other cities as well. Although there are many cities with high population density being exposed to an unplanned urbanization, such cities do not reflect an urban compactness that supports sustainable development proposed by city planners. In other words, a reasonable population and building density in balanced proportion with other urban facilities being supported by an efficient transportation system is a desirable urban compactness accomplishing sustainability objectives. However, promoting theory and practice beyond restrictions - argued about the concept of compact city- needs an

ontological change within compact city theorization (Kjæras, 2020). Internationally comparable indicators can be beneficial in surveillance of compact city policy achievement in cities. The chief indicators of compact city are high density, mix-use, centrality and accessibility (Jenks et al., 2005; Lee et al., 2014; Burton, 2002; Habibi and Zeberedest, 2016; Çalışkan, 2004; Cervero and Kockelman, 1997; Stathakis and Tsilimigkas, 2014; Boussauw et al., 2012; Jia et al., 2022). Then four different cities that are considered as successful examples from perspective of compact city model are examined. The common point in all of these four examples is that all of them have experienced a very rapid urbanization which could lead to a serious urban sprawl but these cities have been successful in handling such a rapid urbanization and increase in population. This study surveys urban policies and practices in these cities to find out the reasons of their success in terms of urban compactness.

Method

This research has chosen case study and comparison method in order to investigate compact city features in four different cities. These four cities are chosen since they have successfully managed to prevent cities from uncontrolled urban sprawl despite a rapid rate of urbanization and increase in the urban population in recent decades. Therefore, planning processes and implemented policies in these case studies (Netherland: Randstad, Canada: Vancouver, Brazil, Curitiba and Singapur) are scrutinized for purpose of this study. Before evaluation of the case studies a theoretical framework on compact city concept and its indicators is given briefly.

Compact City Definition and Indicators

Despite the damages of urban sprawl, the compact city has come to the fore as a model that offers many advantages such as preventing urban sprawl, protecting nature, contributing to the effective and efficient use of infrastructure by putting forward various city forms and some principles under the concept of sustainable city. The compact city phenomenon in scientific sources has been discussed since the late 1970s and early 1980s. However, it was in the 1990s that this model was considered as a sustainability research topic. Even though there is not still any unified definition for concept of compact city, researchers have reached the agreement that compact cities should at least be compact both in terms of physical and functional compaction (Lan et al., 2021). There are many studies that deal with the compactness issue from various dimensions in literature. Burton (2002) stated that the most important problems encountered in compact city studies are the lack of consensus on the definition and meaning of compact city. Similarly, Pratt and Larkham (1996) declared that one of the most fundamental problems about the compact city is the misleading created by the combination of various concepts. The compact city is one of the principal paradigms of sustainable urbanism. Compact city can be defined as city of short distances which promotes high residential density supported by mixed use of land. Compact city presents solutions to the negative effects of urban sprawl and is significant due to its social and economic advantages such as protecting nature and contributing to the effective and efficient use of infrastructure (Bibri et al., 2020).

- **Density**

The most common definition of compact city is a highly dense city model. Within a few decades, many cities in many countries have developed beyond city's central borders. While high density brings many possibilities and benefits for cities, low density and development towards the periphery of the city causes many social, economic and environmental damages. Therefore, today, by realizing this issue, higher density and walkable cities are advocated since they considerably increase liveability (Kotulla et al., 2019). The idea of the 'sustainable city' have progressed from an "organic ecological approach based on a low land coverage index, to the compact and vertical green city". It causes incompatibilities between improving land use and ensuring proper natural indoor environment. It also tries to solve contradictions between "the compact, dense city and predominant personal preferences for individual housing" (Couret, 2022). In the subject of compact city, various density values have been used in the literature from the first emergence of the concept until today. In various periods, researchers have put forward their density proposals that may be the most appropriate according to the city model they have proposed. Each of these suggestions have been appropriate to the requirements of the period and planning objectives of Compact city due to being a sustainable city model. It advocates a density which can create a socially and physically healthy urban space and prevent urban sprawl (Burton, 2002). High density is significant since it increases social capital and urban vitality, promotes public transport, makes local facilities and services accessible and makes recycling and local energy renewal viable (Lee et al., 2018). Furthermore, several researches prove

that high densities cause people to live in spatially proximate to each other, and they have more chance to have spontaneous interaction (Muzayanah et al., 2022). In comparison to residents of lower-density neighborhoods, compact-city residents have higher levels of perceived physical health and personal relationships satisfaction, but higher levels of anxiety and lower levels of emotional response to neighborhood (Mouratidis, 2019). Wang reveals positive correlation between quality of life and compactness (Wang, 2022). Despite many advantages of high density, some investigations particularly during COVID-19 revealed disadvantages of high density. According to Mouratidis (2022) residents of compact neighborhoods testified lower well-being during COVID-19 compared to residents of lower-density neighborhoods. The main reasons are stated as dependence to public transportation, smaller dwellings and less green space.

- **Mixed-use**

One of the most significant principles of the compact city concept is being mixed-use which means providing various urban facilities and services within the residential area and accessible for the residents within walking distance (Jenks and Dempsey, 2007). Mixed-use criteria can be provided both horizontally and vertically. Sherlock (1996) expresses the advantages of mixed-use urban space for city center in this way: "The fact that people always live in the central commercial area means that these spaces will not be a dead space during the night and when offices and workplaces are closed on weekends. "Therefore, the mixed-use factor is of paramount importance in creating a more vibrant and safer environment. In addition, a space full of different activities and full of people

throughout the day has a great effect on creating sense of trustworthiness in people (Sherlock, 1996).

- **Centrality**

Another imperative indicator of a compact city is central physical structure and activity model. Therefore, the condition of existence of three components (high density, concentration and mixed land use) is highly dependent on the **centralization** of urban form in single or multi-core urban structures. It is impossible to concentrate a homogeneous urban settlement throughout the entire area. This is due to the uneven concentration of urban services available only in selected nodes in the city. Such a tendency towards concentration leads to a nucleated structure and gives a compact characteristic to the multicentric cities (Çalışkan, 2004). Therefore, centrality is another chief component of a compact urban form and provides a basis for differentiation in compact urban models and presents a variety of attitudes towards being multicentric or monocenter (Jenks and Burgess, 2000).

- **Accessibility**

When the disadvantages of urban sprawl and excessive usage of personal cars -as fundamental transportation mode in a sprawled city- was revealed, more walkable city models have become the center of attention due to being more healthy, efficient and economic. Compact city model is advocated as a successful urban form due to high walkability and presenting more pedestrian accessibility. As part of the measures to reduce fuel use and greenhouse gas emissions in the compact city concept, discussions about local facilities and services highlight the importance of two aspects of travel behavior (Ali et al., 2019). The first aspect is the mode of transportation used for trips. In particular, it is encouraged to

increase walking and biking as modes of transport and to reduce car usage due to their more energy efficiency. The second aspect is the issue of travel distance particularly in car journeys. In a compact city form with shortened distances, transportation becomes more economic and environmentally healthier due to considerable decrease in fuel costs (Sakamoto, 2018). Directing urban growth towards appropriate focal areas and placing urban facilities and residences close to transportation nodes are extremely important in promoting compact cities. For this reason, it is recommended to provide daily shopping opportunities, particularly at local and regional scales, within accessible distance by walking, bicycle or public transport. The evidences proposes that mixed-use urban development and enhancements in public transit accessibility significantly affect efficient commuting and improvement in public transport directly leads to shorter commute times in high-density urban areas (Jun, 2020). Compact city can also be defined as an accessible city within short distances, contrary to car-oriented accessibility system of a sprawled city. This city model can be characterized by a multifunctional, and multi-modal, well-organized and efficient transport system, whereas encouraging relatively high density of population. Compact city comprises diverse elements including urban containment, mixed use, high density, public transport, accessibility, social equity and (Bhagwat and Devadas, 2020).

Evaluation of Case Studies

Netherland: Randstad

Randstad is populated part of the western Netherlands and encompasses four major cities of the country including Amsterdam, Rotterdam, Hague and Utrecht. Randstad is an open agricultural region which is urbanized around central

green area (Kühn, 2003; Arundel and Ronald, 2017). Dieleman (1996) have argued that such characteristic pattern of urban centers in this region is known as 'Ring City' surrounding the 'Green Heart' and such a polynucleated urban region encompasses an area of approximately 80 by 80 km. The population of the Randstad area has increased from 7.4 million in 1982 to 8.0 million in 1992 and 8.5 million in 2002. Growing population between 1982 and 2002 has been distributed unequally across both space and time (Lambregts and Kloosterman, 2005). Today population density of Runstad is 1,500/km² which makes it one of the most significant economic areas with high density in northwestern Europe (Wikipedia, Randstad, 2021). Dutch national committee adopted policies restricting rapid urbanization in this region leading to urban sprawl in 1950s. Accordingly, "The Second Report on National Spatial Planning" suggested 'Greenheart Metropolis' idea with aim of realizing decentralized concentration of settlement in the Randstad (Kühn, 2003). It proposed deflecting population from the populated western part of the country to the southern and northern parts. However, it took an influential attitude against the suburban sprawl that was transforming into a serious threat, chiefly in the Green Heart. The suggestive solution was channeling suburbanization into "concentrated deconcentration". It leads to settling new urban growth out of the city borders (Van der Wusten and Faludi, 1992). Jenks et al. (2005) advocate this policy as a practicable reconciliation between low-density sprawl of urban activities and urban concentration. This policy was implemented in the late 1970s and early 1980s in Randstad. Thus, this idea of compact urban development has continued as fundamental urban growth

policy of Randstad and generally Netherland. In 1980s, a shift can be observed in policy of compact urban development. The chief reason of the change was the decay of the old urban cores. Ultimately, this policy was fell into desuetude. Instead, an original concept about compact urban development was appeared. According to this new policy the government tried to apply new urban redevelopment projects within existing territory of the city borders. For this purpose, 'brown' sites and later new greenfield sites were adjacent to the cities of Randstad. Greenfield expansion policy was articulated in the "Fourth Report on Physical Planning Extra" being prepared in 1991. Planning interventions of fourth report aimed to conserve large areas of the Green Heart (Dielman, 1997). The next spatial plan strategy in Netherland similarly has aimed intensified land-use and developing a multi-modal transport network (Snellen and Hilbers, 2007). A particular emphasize is put on encouraging walking, biking and public transportation and this is more promoted by creating mixed-use residential neighborhoods. Generally, success of Rundstad in terms of urban compactness policy is majorly connected with appropriate planning tradition and in general Netherland's planning organization which is closely related to welfare state policies of the country (Çalışkan, 2004). Approximately whole the land dedicated to urban development is conceded and controlled by public agency in the Netherlands. This can be shown as the reason for successful compact city policy of Netherland's planning principles (Faludi and Van der Valk, 1994).

Canada: Vancouver

Vancouver is the third major metropolis of Canada and is considered as the largest city of British Columbia.

Furthermore, Vancouver is a significant coastal seaport on the mainland. According to census data since 1921 till today a rapid growth can be seen in population rate of Vancouver. Therefore, population is estimated to reach three million in 2031 (GEOG471, 2021). As stated by the 2016 census, the population of the metropolitan area was 2,463,431, while the population of the city was 631,486 (The Canadian Encyclopedia, 2021). Today, Vancouver's population density is over 5,400 people per square kilometre (Wikipedia, 2021). The city's vital downtown and "excessive inner suburbs" with slightly high density and mixed-use residential areas are not disrupted by the estranged freeway land attribute of similar U.S.A. inner cities. Accordingly, Vancouver inner city has a high level of walkability and is appropriate for cycling. Vancouver's main traffic arteries are majorly highly dense with mixed-use developments. These arteries own wide walkable safe and attractive sidewalks encouraging walking and cycling. Travel speed is relatively slow in this area in order to provide pedestrians with more safe and secure sidewalks. Thus, Vancouver in contrast to many other north American cities has considerably decreased automobile dependency (Newman and Kenworthy, 1999: 141-144). Vancouver 1950s and 1960s transportation plans has suggested bountiful networks of freeways through the inner city and concentrated mainly in Central Business District of the city. At the same time community-based movements objected and criticized against keeping freeways within central and inner parts of Vancouver. Light rapid transportation systems of Vancouver called "sky train" which construction ended in 1986 can be considered as the most chief regional growth mechanism of the city. This sistem aimed to create liveable regions

and direct growth along a corridoric structure. Therefore, new sub-centres would be concentrated throughout these corridors. Skytrain as the most vital transportation system of vancouver runs throughout development corridor of the city. Industrial areas along these corridors -some of which were vacant and out of use- were rezoned in order to create residential areas with high density and mixe of urban uses (Çalışkan, 2004). Accordingly, this planning strategy was characteristicly reflecting compact city attributes. Redevelopment was focused on vacant lands along railway corridor with respect to compact form. Development through intensification in such areas was directed by particular purposes such as enhancing mixed-use development, promoting residential development with medium to high level of density, creation of diverse and characteristic subcentres and decreasing the negative effects of traffic and parking problems (Newman and Kenworthy, 1999). In context of decenralization of CBD activities diverse job oppourtunities, shopping alternatives and residential areas with high density were integrated. By so doing, Central Business District was regenerated by doing this through increasing mixed-use of residential, work and leisure activities. Accordingly, this plan has lead to more compact city form for Vancouver city which can be considered as a scarce compact city form among north American cities. Also researches on transportation system of Vancouver has revealed its success on creating a cost-effective and sustainale transportation system which is one of the most crucial requirements of a compact city (Babalik Sutcliffe, 2002). New residential developments along nodes consists of a wide range of housing alternatives from high rise towers to three or four storey apartments. Addinonally, work and

residential buildings are well integrated with mixed commercial and other urban users within walking distance to stations. Therefore, well-integrated transportation infrastructure with diverse activities of built environment represent a potentially compact urban design example (Newman and Kenworthy, 1999).

Brazil, Curitiba

Curitiba, the capital city of the Brazilian state of Paraná's population was 1,908,359 in 2017 and its population density was 4,062/km² (10,523/sq mi) (IBGE, 2017). Curitiba's 2020 population is now approximately 3,678,732. The Metropolitan area of Curitiba encompasses 26 municipalities, with a combined population reaching over 3.2 million (World Population Review, 2020). Curitiba's urban planning experience is not only a good practice for many developing countries but it is also one of the significant sustainability models in urban planning literature. Its originality is due to the successful integration of transportation system, land use and housing strategies involving in an energy-efficient urban form. Considering the planning history of this city, the Agache Plan was developed in 1943 by a French city planner named Alfred Agache. One of the main possibilities in Agache's plan required full motorization of the city and "great boulevards emerging from the central core" were necessary to meet the expected increases in automobile traffic. The Agache Plan was influenced by the French Haussman's tradition of monumental public projects and required massive infrastructure investments that would flatten many of Curitiba's oldest historic buildings (Cervero, 1998). In Agache plan, the city center was connected to the rest of the city through rings of concentric circles. Unlike modern Curitiba, the city was planning

to expand the interconnectedness of the city through car access transportation mode and public transportation did not have a key role in transportation network of the city (Shrivastava , 2009). In 1965 a new master plan was provided for the city. The new plan deviated from the previous plan design of a tiered city with concentric circles in favor of a more concentrated and controlled form of growth along specified axes. Instead, the design had to be linear allowing growth to occur along identified roots to prevent the city from becoming an expanding metropolis (Cervero, 1998). The previous plan was concentric. In order to get from one area to another, both public and private traffic had to pass through the center and it would soon lead to traffic congestion in city center. Accordingly, the streets had to be widened and spirals of destruction and bottleneck had begun. The new plan was spread linearly along five structural axes determined from the city's core. Thanks to the old structural axis, public transport routes were reproducible and allowed new structural axes as extensions. The public transport system operated on a network arranged based on the buses. Land acquisition policy was introduced to expand the bus network through intensification. Densification, which is a precondition for public transport, was realized by encouraging people to use public transportation rather than private cars (Hidalgo, 2022). Encouraging mixed-use and highly dense housing along the main road was another significant policy being implemented in the city. As a result of the optimization of land, infrastructure and public investments, the floor area ratio (FAR) increased from 1 to 6 as a gross population density of 600 people per hectare. Average gross density reached up to 100 dwelling units per hectare in

line with the structural axes (Acioly , 2000).

The main objectives of 1965 Master Plan can be expressed as:

- Keeping the urban population within the boundaries of their own region
- Preventing the city center from congested traffic and preserving its traditional functions
- Providing urban infrastructure for the whole city (Shrivastava, 2009).

Looking at the city of Curitiba today shows the success of this approach. The buildings range from the cluster of tall buildings in the city center to the clearly defined edge of the city along transport axes. Curitiba has been an example of a successful city in integrating land use and transportation network. The land in the two blocks of the bus route has been zoned for commercial and residential use. Moreover, these two blocks, regional housing densities are narrowing with the distance to bus routes. After the widely publicized “Bus Rapid Transit (BRT)” successes in Curitiba, new kilometers of fast BRT lines have been added today and have received special attention in the developing world (Cervero, 2014).

Singapore

Singapore, formally known as the Republic of Singapore, is an island nation located at the southern part of the Malay Peninsula, 137 kilometers north of the equator. Singapore, which is a rectangular country closed by the Singapore Strait, has an area of approximately 7000 km² with its 40 islets. Today, population density in Singapore has reached 8358 people per km² (21,646 people per mi²) (Singapore Population, 2020). Today, Singapore can be considered as a successful example of compact urban development. From 1986 to 1994, Singapore's urban development was scattered across the island. During this period, the development area

increased from 337 km² to 492 km², while the vegetation areas decreased from 74 km² to 55 km². Despite of decrease in built-up area between 1998 and 2003, a considerable increase of about 86% has been determined in natural conservation. Today, about 50% of Singapore's land area is covered by green areas (Singapur Compact City Approach, 2022). Increase in urban density of metropolitan area in Singapore dates back to the 1970s. within that decade, the advice of the World Bank and American advisors presented diverse proposal plans enhancing public bus services, which were more efficient and economic than fixed transportation systems, in order to solve the problems caused by increased mobility and traffic congestion. In contrast, the Singapore authorities selected the UN Development program policy alternative based on the rail system. The purpose was to lead urban growth through transitional urban development. In this sense, buses lonely were not adequate to control metropolitan development (Newman and Kenworthy, 1999). As part of a UN Urban Renewal and Development Project under the UN Development Program (UNDP) a four-year City Planning Project (1967-1971) was initiated. The project resulted in Singapore's first Concept Plan (1971) which set out the development requirements for a projected population of four million by 1992. This Plan provided basement for future urban growth -which encourages protection of lands for future developments- and proposed the MRT (Mass rapid transit) system. Whereas the 1971 Concept Plan was majorly formed by housing and economic requirements, the 1991 Concept Plan concieved Singapore's transformation into a ‘Tropical City of Excellence’ which supported

anappropriate balance among workplaces, commercial activities and provided a wide range of recreational and leisure activities (Tan and Ee, 2019: 83). The next concept plan prepared in 2001 estimated a population of 5.5 million people. This concept plan’s emphasize was on creating sustaiable and particularly liveable urban environment with increased green

spaces. This concept plan has considered commercial requirements of changing business system in singapore (Tan and Ee, 2019). Figure 1 demonstrates the main objectives of three concept plans prepared for singapuor respectively in 1971, 1991 and 2001. The objectives of each plan is explained in Table 1 and shown in figure 1.

Table 1. The aims of three different concept plans prepared for Singapore(Tan and Ee, 2019).

1971	1991	2001
<ul style="list-style-type: none"> - First concept plan, prepared with aid from the United Nations development Program - Population Limit: 3.4 million by 1992 - This plan’s main appendage was a “Ring Plan” structure which ordered satellite towns with high density around a central collecting area. 	<p>Population Limit: 3.66 million by 2030 and 4 million by Year X</p> <p>This plan’s main appendage was decentralization strategy to form a hierarchy among commercial centers, encompassing regional, sub-regional and fringe centers, This plan also suggested chronological corridors to enhance innovations.</p>	<p>Population Limit: 5.5 million by 2041 – 2051</p> <p>Ensuring a high-quality living environment</p> <p>Converting Singapore to a universal financial center creating a characteristically rich city in terms of cultural and social heritage</p> <ul style="list-style-type: none"> - Achieving the public via wide-ranging public negotiations

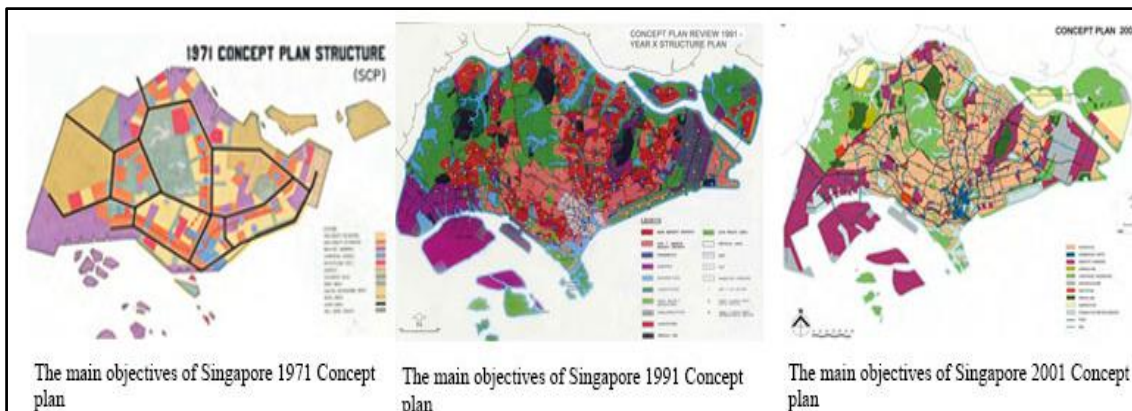


Figure 1. Concept plans prepared for Singapore and aims of each plan (Tan & Ee, 2019: 23-27).

In general, one of the most chief criteria in designing new cities in Singapore is self-sufficiency. Effectual self-sufficiency is supplied with urban design strategies including high density and mixed land use model and in land use planning, encouragement of non-motorized transportation modes is significant. The adjacent integration of

train stations and decentralized commercial districts provides a high level of local accessibility to node centers within a five-minute walk and mixed-use cores are supported by an inclusive pedestrian and bicycle network (Cervero, 1998; Newman and Kenworthy, 1999).

RESULTS and DISCUSSION

Elaboration of urban policies within last half of century in four chosen case studies presented significant clues

about compact city polices. These policies for each of case studies are summarized in Table 2.

Table 2. Compact City Policies Implemented in Case Studies

City and Location	Population Density(people /km ²)	Major Policies towards Compact City
Netherland: Randstad	1,500/km ²	<ul style="list-style-type: none"> - Urban redevelopment within existing territory of city borders by adjacent of 'brown' sites and later new greenfield to Rundstad (1980s). - Conservervation of huge areas of the Green Heart as main objective of “Fourth Report on Physical Planning Extra” (prepared in 1991). - Intensification of land-use and creating mixed-use residential neighborhoods. - Developing a multi-modal transport network. - Encouraging walking, biking and public transportation.
Canada: Vancouver	5,400/km ²	<ul style="list-style-type: none"> - LRT(light rapid transportation) systems of Vancouver (sky train) which constructions ended in 1986 created liveable regions and directed growth along a corridoric structure with new sub-centres . - Rezoning vacant industrial areas along LRT corridors in order to create heighly dense and mixed-use residential areas. - Promoting residential development with medium to high level of density - Creation of diverse and characteristic subcentres and decreasing the negative effects of traffic and parking problems. - Regeneration of CBD by increasing mixed-use of residential, work and leisure activities.
Brazil: Curtitibia	4,062 / km ²	<ul style="list-style-type: none"> - Concentric circles proposed in 1965 Master Plan to create more focused and controlled form of development along determined axes. - Densification, which is a precondition for public transport, was realized by encouraging people to use public transportation rather than private cars. - Promoting mixed land use and high density housing development throughout the main road . - Kilometers of “fast BRT lines” by which the land in the two blocks of the bus route has been zoned for commercial and residential use.
Singapur	8358/ km ²	<ul style="list-style-type: none"> - Improvement of bus services and later fixed transport systems to direct urban growth through transitional urban form(since 1970s). - Self-sufficiency provided with high density and mixed-use development. -Non-motorized modes of transport promoted by Land use planning. - Providing a high level of local access to node centers within a five-minute walk by integrating train stations and decentralized commercial districts. - Compact, mixed-use cores supported by comprehensive pedestrian and bicycle networks.

The different planning orientation between the case studies offers a number of key perspectives in context of compact city concept in a wider frame:
 1.Utilization of brown fields and vacant lands within city for development of new constructions instead of directing new developments out of city borders can

considerably restrict urban sprawl and realize urban compactness objectives.
 2. Creating subcenters with diverse characteristic in order to decrease the negative effects of traffic and parking problems in city centers can decrease traffic congestion, sound and air pollution of city center.

3. Since densification is a precondition for public transport, taking appropriate actions in order to increase density of existing area within city borders can both restrict urban sprawl and car-dependency and enhance public transportation usage.

4. Since, walkability of urban space and providing necessary requirement within walking distance is one of fundamental principles of a compact city, creating mixed-use neighborhoods with high design quality and providing urban facilities within walking distance can encourage walking and biking as non-motorized transport modes.

5. Strengthening city center by enhancement of attractive mixed-use urban space not only would be effective in vitalization of city center but also would be influential in preventing urban sprawl.

Accordingly, the guided densification policies in four case studies present successful examples of how municipalities and authorities are capable of efficiently using city's existing lands for development purposes. Furthermore, all the four case studies demonstrate the significant role of a successful and inclusive public transport network and reciprocation between urban intensification and public transportation.

A detailed investigation of intra-urban potentials for urban development and urban intensification offers a comprehensive foundation for better maximization of public services, efficient use of available lands and infrastructure, increasing housing opportunities and promoting local economic development. The ultimate consequence of implementing such a beneficial policy would be achieving cities that accomplish key objectives of compact city with increased social

equity, economic efficiency, vital and mixed-use urban spaces.

CONCLUSION

Since the compact city model is a sustainable city model, it provides the right amount of density and advocates adjusting the density in a way that both creates a socially and physically healthy urban area for people and prevents urban sprawl. Considering compact city arguments as a whole, it can be concluded that there is a significant gap between theory and practice on the subject. Accordingly, many compact cities claim in literature (both among those who defend the issue and those who criticize or reject it) are the theories and concepts that should be proven. When we look at the resources related to sustainable development, the main driving force behind the sustainable urban form model is identified as the pursuit of uncontrolled use of energy and the consumption of diminishing resources. These are significant elements of today's urban agenda. In the position reached from a sustainability viewpoint, it is extensively argued that solutions which are not multi-purpose will not be adequate both in terms of technical and social. On the contrary, it is thought that there is a much greater need for a more structural transformation of the space. If the strategic practicability of the compact urban form is not enucleated, it cannot be offered to policy makers as a sensible development policy. In order to evade this handicap, any theories and claims on the issue should be supported by design criteria and principles both in macro and meso scales. As a result of the examination of the study samples on the basis of the concept of compact city, urban sprawl processes and causes differ depending on the development speed of the country, particularly where the cities are located. Accordingly, approaches to urban compaction also differ. Due to

various reasons, the emergence of the negativities of urban sprawl and the developments in the direction of suburbanization over time have been the basis of compact city, revitalizing urban centers and similar ideas. Since the concept of compact city emerged in developed countries through predetermined design codes after urban sprawl, it is a planned and accessible model, which is basically called densification, and one of its main goals has been to prevent further sprawl by increasing the density in the existing lands. In underdeveloped or developing countries, urban sprawl differs both in quality and quantity. For this reason, while defending the compact city thesis for such cities, it may be meaningless and strange for most of those that focus on urban density and to emphasize this aspect of it, since they have a dense and compact city fundamentally. In this sense, it is a fact that in most such cities it is necessary to avoid urban density. For this reason, excessive density in underdeveloped or developing countries has sometimes been an inevitable result of the compulsory conditions brought by the low economy and has been the kind that can be described as agglomeration in unqualified urban textures. Therefore, in a country such as Brazil which has struggled with problems of densified slums for many years, defining compact city with emphasize on densification of population seems unacceptable. In such cases adequate number of urban equipment, providing mixed-use, and having qualified and walkable streets in walking-oriented neighborhoods come to the fore rather than the density factor. It should be noted that a certain level of density is a chief requirement in the concept of compact city, however this criterion does not always provide adequate condition for providing a livable urban density in the

contemporary perspicacity. In this sense, the uncoordinated process of densification and the lack of balance between density and the provision of urban infrastructure and facilities cannot adequately fulfill the objectives of the compact city idea. For such a purpose, the following planning policies can be suggested for compaction:

1. Imposing restrictions on development rights in order to protect green lands of city periphery from getting destroyed for the purpose of rent and profit.
 2. Increasing publicly owned urban land stocks to guide future development trends; This issue is effective in making open spaces and green lands more controllable in order to protect them.
 3. Increasing infrastructure investments in planned existing urban areas would be a significant step to prevent further construction in the vacant lands of city periphery and to prevent urban sprawl.
- The compact city concept has remained more of a theoretical idea for many reasons. In order to ensure its applicability, transparent compact urban design principles and factors that can be included in planning should be introduced. Thus, each country and even the city's physical, geography, climatic conditions, socio-cultural infrastructure, etc. should be considered while decisions are taken. Such an attitude and taking the characteristics of the city into account can prevent further urban sprawl.

REFERENCES

- Abdullahi, S., Pradhan, B. 2018. Land use change modeling and the effect of compact city paradigms: integration of GIS-based cellular automata and weights-of-evidence techniques. *Environmental Earth Sciences*, 77(251), 1-15.

- Acioly, J. 2000. “Can Urban Management Deliver Sustainable City? Guided Densification in Brazil versus Informal Compactness in Egypt”. in *Compact Cities: Sustainable Urban Forms for Developing Countries* Eds M. Jenks, R. Burgess (s. 127-139). içinde London: Spon Press.
- Ali, Y., Rezai, M., De Felice, F., Sabir, M., Petrillo, A. 2019. A VIKOR based approach for assessing the social, environmental and economic effects of “smog” on human health. *Science of The Total Environment*, 650(2): 2897-2905.
- Artmann, M., Inostroza, L., Fan, P. 2019. Urban sprawl, compact urban development and green cities. How much do we know, how much do we agree? *Ecological Indicators*, 96(2): 3-9.
- Arundel, R., Ronald, R. 2017. The role of urban form in sustainability of community: The case of Amsterdam. *Environment and Planning B: Urban Analytics and City Science*, 44(1): 33–53.
- Babalik Sutcliffe, E. 2002. Urban rail systems: Analysis of the factors behind success. *Transport Reviews*, 22(4): 415-447.
- Bhagwat, M., Devadas, V. 2020. Planning for a sustainable compact city: A way forward. *Sustainable Development and Planning*, 241: 113–122.
- Bibri, S., Krogstie, J., Kärrholm, M. 2020. Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment*, 4: 1-20.
- Boussauw, K., Neutens, T., Witlox, F. 2012. Relationship between Spatial Proximity and Travel-to-Work Distance: The Effect of the Compact City. *Journal of Regional Studies*, 46(6):687-706.
- Burton, E. 2002. Measuring urban compactness in UK towns and cities. *Environment and Planning B: Planning and Design*, 29: 219-250.
- Çalışkan, O. 2004. *Urban Compactness: A Study Of Ankara Urban Form*. Ankara: Middle East Technical University.
- Cervero, R., Kockelman, K. 1997. Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Part D: Transport and Environment*, 2(3): 199-219.
- Cervero, R. 1998. Creating a Linear City with a Surface Metro: Curitiba, Brazil. In *The Transit Metropolis: A Global Inquiry* . (1st ed., ss. 265-293). Washington, D.C.: Island Press.
- Cervero, R. 2014. Transport Infrastructure and the Environment in the Global South: Sustainable Mobility and Urbanism. *Jurnal Perencanaan Wilayah dan Kota*, 25(3).
- Couret, D. 2022. Sustainable urban development. Cuban challenges. *International Journal of Urban Sustainable Development*, 1-5.
- Dielman, F. 1997. “Planning compact urban form: Randstad Holland 1965-95”, *Environment and Planning B: Planning and Design* 29:1711-1715.
- Faludi, A., Van der Valk, A. 1994. *Rule and Order: Dutch Planning Doctrine in the Twentieth Century* (Kluwer: Dordrecht).

- Geog471. 2021. Geography department. Vancouver Density: <https://ibis.geog.ubc.ca/courses/geob479/classof08/vandensify/introduction.html>
- Habibi, S., Zebardast, E. 2016. How Compact Are Midsize Cities in Iran? *Urban Plann. Dev.*, 142(4):1-11.
- Hidalgo, D. 2022. Curitiba is evolving but remains a model for urban sustainability. <https://city2city.network/curitiba-evolving-remains-model-urban-sustainability>
- Holdon, E., Norland, I. 2005. Three challenges for the compact city as a sustainable urban form: Household consumption of energy and transport in eight residential areas in the greater Oslo region. *Urban Studies*, 42(12): 2145 – 2166.
- IBGE. 2017. GE releases population estimates for municipalities in 2017. Brazilian Institute of Geography and Statistics (IBGE) (August 30, 2017)". ibge.gov.br. Archived from the original on 12 June 2018. Retrieved at 30 August 2017. <https://cidades.ibge.gov.br/brasil/pr/curitiba/panorama>
- Ismael, H. 2021. Urban form study: the sprawling city—review of methods. *GeoJournal*, 86: 1785–1796.
- Jenks, M., Burgess, R. 2000. *Compact Cities: Sustainable Urban Forms for Developing Countries*. London and New York: Spon Press.
- Jenks, M., Burton, E., Williams, K. 2005. *The Compact City: A Sustainable Urban Form*. Oxford: Spon Press.
- Jenks, M., Dempsey, N. 2007. Defining the neighbourhood: Challenges for empirical research. *The Town planning review*, 78(2): 153-177.
- Jia, M., Zhang, H., Yang, Z. 2022. Compactness or sprawl: Multi-dimensional approach to understanding the urban growth patterns in Beijing-Tianjin-Hebei region, China. *Ecological Indicators*, 138: 1-11.
- Jun, M.J. 2020. The effects of polycentric evolution on commute times in a polycentric compact city: A case of the Seoul Metropolitan Area. *Cities*, 98.
- Kjæras, K. 2020. Towards a relational conception of the compact city. *Urban Studies*, 58(6): 1176–1192.
- Kühn, M. 2003. “Greenbelt and Green Heart: separating and integrating landscapes in European city regions”. *Landscape and Urban Planning*, 64: 19-27.
- Kotulla, T., Denstadli, J., Oust, A., Beusker, E. 2019. What Does It Take to Make the Compact City Liveable for Wider Groups? Identifying Key Neighbourhood and Dwelling Features. *Sustainability*, 11: 1-18.
- Lambregts, B., Kloosterman, R. 2005. *Commuting & the Definition of Functional Urban Regions*. Institute of Community Studies/The Young Foundation & Polynet Partners, - Contributions: Polynet Partner Members - Selection & editorial material: Peter Hall & Kathy Pain.
- Lan, T., Shao, G., Xu, Z., Tang, L., Sun, L. 2021. Measuring urban compactness based on functional characterization and human activity intensity by integrating multiple geospatial data sources. *Ecological Indicators*, 121: 1-12.

- Lee, J., Kurisu, K., An, K. 2014. Development of the compact city index and its application to Japanese cities. *SAGE Journals, Urban Studies*, 52(6): 1054-1070.
- Lee, S., Yoo, C., Ha, J., Seo, J. 2018. Are perceived neighbourhood built environments associated with social capital? Evidence from the 2012 Seoul survey in South Korea. *International Journal of Urban Sciences*, 22(3): 349–365.
- Mouratidis, K. 2019. Compact city, urban sprawl, and subjective well-being. *Cities*, 92: 261–272.
- Mouratidis, K. 2022. COVID-19 and the compact city: Implications for well-being and sustainable. *Science of the Total Environment*, 811: 2-11.
- Muzayanah, E., Nazara, S., Mahi, B., Hartono, D. 2022. Social capital vs. anonymity? 3Ds Urban form and social capital development in Indonesian cities. *International Journal of Urban Sustainable Development*, 14(1): 108-125.
- Newman, P., Kenworthy, J. 1999. *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press.
- Organization, World Health. 2014. *Global Health Observatory (GHO) data. Urban population growth*: https://www.who.int/gho/urban_health/situation_trends/urban_population_growth/en/
- Pratt, R., Larkham, P. 1996. Who will care for compact cities? in *The Compact City: A Sustainable Urban Form?* Eds M Jenks, E Burton, K Williams. London: Spon.
- Rubiera-Morollón, M., Garrido-Yserte, R. 2020. Recent Literature about Urban Sprawl: A Renewed Relevance of the Phenomenon from the Perspective of Environmental Sustainability. *Sustainability*, 12.
- Sakamoto, K., Iida, A., Yokohari, M. 2018. Spatial patterns of population turnover in a Japanese Regional City for urban regeneration against population decline: Is Compact City policy effective? *Cities*, 81: 230–241.
- Sherlock, H. 1996. "Repairing our much abused cities: the way to sustainable living". Eds M Jenks, E Burton, K Williams içinde, in *The Compact City: A Sustainable Urban Form?* (s.289-297). London: Spon.
- Shrivastava, P. 2009. *Exploring Compact city: Reconfiguring the Compact City*. Ball State University Muncie, Indiana : A thesis submitted to the graduate school in partial fulfillment for the degree of master of architecture.
- Singapore Population. 2020. [https://www.worldometers.info/world-population/singapore-population/#:~:text=Singapore%20population%20is%20equivalent%20to,21%2C646%20people%20per%20mi2\).](https://www.worldometers.info/world-population/singapore-population/#:~:text=Singapore%20population%20is%20equivalent%20to,21%2C646%20people%20per%20mi2).)
- Singapur Compact City Approach. 2022, April 21. *Urban diary*. <https://urbandiartist.wordpress.com/2014/04/21/singapore-compact-city-approach-public-housing-lesson-for-asian-countries/#:~:text=Singapore%20is%20an%20essential%20example,system%20development%20for%20the%20society.>
- Snellen, D., Hilbers, H. 2007. mobility and congestion impacts of Dutch VINEX Policy. *Tijdschrift voor economische en sociale geografie*, 98(3): 398-406.

- Stathakis , D., Tsilimigkas, G. 2014. Measuring the compactness of European medium-sized cities by spatial metrics based on fused datasets. *International Journal of Image and Data Fusion*, 5(4): 42-64 .
- Tan, J., Ee, D. 2019. *Ground Breaking :60 Years of National Development*. MND Singapore , The Centre for Liveable Cities.
- The Canadian Encyclopedia. (2021). Last Edited on March 12, 2019. Vancouver: https://thecanadianencyclopedia.ca/en/article/vancouver?gclid=Cj0KCQiA0rSABhDIARIsAJtjfCdkjHgBACqYh_DZiVcbE5S4r6VjuKb60rEpMh8evu9pIksgmUdB86kaAsT8EALw_wcB
- Van Der Valk, A., Faludi, A. 2002. Growth Regions and the Future of Dutch Planning Doctrine. in *Sustainable Development and Urban Form* Ed M. Breheny (Pion Limited, London) (s. 122-137). içinde
- Wang, H. 2022. Prioritizing compactness for a better quality of life: The case of U.S. cities. *Cities*, 123: 1-12.
- Wikipedia. 2021. Randstad. <https://en.wikipedia.org/wiki/Randstad#:~:text=With%20a%20population%20density%20of,Rottterdam%E2%80%93The%20Hague%20metropolitan%20area>.
- Wikipedia. 2021. Vancouver. <https://en.wikipedia.org/wiki/Vancouver>
- World Population Review. 2020. Curitiba Population 2020. <https://worldpopulationreview.com/world-cities/curitiba-population>