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Causes, results and methods of controlling urban sprawl

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Abstract

Urban sprawl is an issue that has allocated many discussions to itself in academic, policy making and executive departments. Although sprawl is an American phenomenon, but it should be indicated that it's different by environmental, economic, social and political situations. In recent decades, urban growth has not been adopted with residents needs and as a result of this process, many lands have been utilized for construction. Regarding to mentioned issues in cities, this article attempts to surveys the results of sprawl by precise cognition of characteristics and causes and introduces appropriate policies at the end of it. Controlling travels, participation in providing infrastructures costs, controlling growth and protection of lands and redevelopment of inner-core regions are some of proposed policies

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1. Introduction

Urban sprawl is one of the problems in the cities nowadays. In the past decades cities had define and specific boundaries, but they have missed their realms by excessive growth today. The word of “Urban Sprawl” means more growth than the usual and what makes it different from urban growth is this excessive nature. Cities tend to growth and planned growth is reached while there is an appropriate proportion between urban growth and urban organism. But when the growth is more than usual, its pressure on the boundaries, city will face new major problems.

Based in these facts, it is necessary to survey different aspects of urban sprawl thus it gives opportunity

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to prevent or control negative effects of that. In this research, due to extensive theoretical contexts existing, we apply comparative and deductive methods. In other words, by surveying different viewpoints about sprawl, its characteristics and results are extracted. Then making relation generalized, we introduce some policies. These policies can be used in every country according to its characteristics and conditions.

2. Characteristics of urban sprawl

There are many definitions on urban sprawl. In oxford dictionary it has been defined as “the disorganized and unattractive expansion of an urban or industrial area into the adjoining countryside”. In the other references, according to their viewpoints and goals, they have emphasized on special aspects. The European Environment Agency (EEA) has described sprawl as the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas. Sprawl is the leading edge of urban growth and implies little planning control of land subdivision. Development is patchy, scattered and strung out, with a tendency for discontinuity. It leap-frogs over areas, leaving agricultural enclaves [1]. Downs believes that sprawl does not mean every kind of growth and it has a definite form that can be introduced as unlimited outward extension of development, low-density residential and commercial settlements, leapfrog development, fragmentation of powers over land use among many small localities, dominance of transportation by private automotive vehicles, lack of centralized planning or control of land uses, widespread strip commercial development, great fiscal disparities among localities, segregation of types of land use in different zones, and reliance on the trickle-down or filtering process to provide housing to low-income households [2].

Brueckner refers urban sprawl to excessive spatial growth of cities [3]. From Gordon and Richardson viewpoints, urban sprawl includes increasing income inequality, job insecurity, central-city decline, increasing housing costs, long commutes, environmental problems, species extinction, loss of farmland, a sense of isolation, elevated blood pressure, muscle tension, intolerance, psychological disorientation, and even murder and mayhem [4]. Ewing has introduced four sprawl factors that can be measured and analyzed: residential density; neighborhood mix of homes, jobs, and services; strength of activity centers and downtowns; and accessibility of the street network [5]. In other research he believes that the most important indicators are poor accessibility and lack of functional open spaces [6].

Galster knows sprawl as a metaphor rich in ambiguity. Sprawl has been denounced on aesthetic, efficiency, equity and environmental grounds and defended on choice, equality and economic grounds. Eight dimensions of sprawl are density, continuity, concentration, clustering, centrality, nuclearity, mixed uses and proximity [7]. Song and Zenou have introduced urban sprawl by low density developments in the border of cities. In this process the usage of lands is much more than population growth rate [8]. Sierra club define sprawl in their report of *The Dark Side of the American Dream*: “low-density development beyond the edge of service and employment, which separates where people live from where they shop, work, recreate and educate—thus requiring cars to move between zones”. They believe that Sprawl defined not only by its characteristics, but by its effects [8]. Glaeser related sprawl to the degree of decentralization of employment [9]. Pendall defined sprawl as “unplanned, uncontrolled, and uncoordinated single-use development that does not provide for an attractive and functional mix of uses and/or is not functionally related to surrounding land uses and which variously appears as low density, ribbon on strip, scattered, leapfrog or isolated development [10]. Angle characterized attributes of urban sprawl as:

- The walkable range and the emergence of ‘endless’ cities;
- The persistent decline in urban densities and the increasing consumption of land resources by urban dwellers;
- Ongoing suburbanization and the decreasing share of the population living and working in

metropolitan centers;

- The diminished contiguity of the built-up areas of cities and the fragmentation of open space in and around them; and
- The increased compactness of cities as the areas between their fingerlike extensions is filled in.

Measuring urban sprawl is a useful way to develop the policies. Sprawl should be surveyed by its causes and results as a pattern or as a method [11]. Kahn explored one potential benefit of sprawl, increased housing affordability and greater equality of housing opportunity across racial lines. Sprawl is represented by the degree of employment decentralization in a metro area, specifically, by the proportion of metropolitan employment located more than 10 miles from the central business district [12]. From Fulton viewpoint if land is consumed at a faster rate than population is growing, Sprawl is said to be increasing. This concept of sprawl is strictly density related [13]. In the couch studies in Merseyside surveyed urban sprawl by:

- Changes in urban density at different distances from the city center
- The amount or proportion of development that has occurred beyond the existing urban area
- The volume and mode of transport demand.

He evaluated the impact of these factors in three dimensions: social, economic and environmental [14]. Conclusion of these viewpoints has summarized in table (1).

Table 1. Viewpoints about urban sprawl characteristics

| Viewpoint | Quantity |
|---------------------------------|--|
| The European Environment Agency | Physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas. |
| Downs | Unlimited outward extension of development, Low-density residential and commercial settlements, Leapfrog development, Fragmentation of powers over land use among many small localities, Dominance of transportation by private automotive vehicles, Lack of centralized planning or control of land uses, Widespread strip commercial development, Great fiscal disparities among localities, Segregation of types of land use in different zones, and reliance mainly on the trickle-down or filtering process to provide housing to low-income households |
| Brueckner | Excessive spatial growth |
| Godon & Richardson | Increasing income inequality, Job insecurity, Central-city decline, Increasing housing costs, Long commutes, Environmental problems, Species extinction, Loss of farmland, Sense of isolation, Elevated blood pressure, Muscle tension, intolerance, Psychological disorientation, and even murder and mayhem |
| Ewing | Residential density, Neighbourhood mix of homes, jobs, and services, Strength of activity centers and downtowns, and Accessibility of the street network |
| Galster | Density, Continuity, Concentration, Clustering, Centrality, Nuclearity, Mixed uses, and proximity |
| Song and Zenou | Low density development in the border of the cities |
| Sierra club | Low-density development beyond the edge of service and employment, Zoning, more usage of cars |
| Glaeser | Decentralization of employment |
| Pendall | low density, Ribbon on strip, Scattered, Leapfrog or isolated development |
| Angle | Distance, Using of lands, Density, Fragmentation and fingerlike extensions |
| Kahn | Employment decentralization |
| Fulton | Density |
| Couch | Changes in urban density at different distances from the city centre, The amount or proportion of development that has occurred beyond the existing urban area, The volume and mode of transport demand. |

3. Surveying some samples of sprawled cities

Although researches on sprawl originated in the studies of the American cities, but it has been used in many different countries with various natures, indexes and results. Here, we survey some examples in U.S.A., Europe and Asia.

3.1. The sprawl in the USA

In the USA land consumption has gone from 161 square miles per 1,000 inhabitants in 1950 to 243 in 1970, and 293 in 1990 in the metropolitan areas of more than one million inhabitants. The aforementioned urbanized areas has analyzed by comparing the land consumption in 1990 and 2000. The yellow tone indicates the urbanized areas in 1990 with the red tone indicating the urbanized land in 2000.

The urbanized area of New York-Newark, NY-NJ-CT has a land consumption of 455.17 m² per 1,000 inhabitants in 1990 that reached to 487.82 in 2000. The other example in USA is urbanized is Chicago. The urbanized area of Chicago, IL-IN has a land consumption of 615.42 m² per 1,000 inhabitants in 1990 reaches to 661.79 in 2000[15].

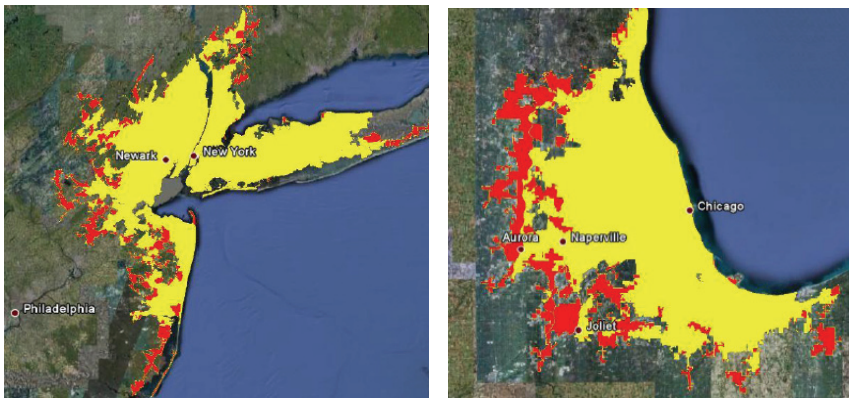


Fig. 1. (a) Urban growth of UA of New York-Newark, NY-NJ-CT;(b) Urban growth of UA of Chicago, IL-IN

3.2. The sprawl in the Europe

Considerable examples in Europe are Spain and Portugal. The predominant pattern of residential urbanization is diffuse settlements adjacent to or disconnected from concentrated urban centers. Residential sprawl is on average responsible for more than 45 % of coastal zone land transformation into artificial surfaces. There is an increasing demand for investment in coastal residences due to tourism and leisure from northern Europe. In addition, there is also domestic demand from the inland population, e.g. the retired. Portugal's urban development is concentrated around the two metropolitan areas of Lisbon and Porto, along the coastline from Lisbon/Setubal to Porto/Viana do Castelo, and more recently along the Algarve coast. In Spain, economic growth and tourism has resulted in an increased number of households and second homes particularly along the Mediterranean coast. Illustrative of this phenomenon are the Costa del Sol and Costa Brava which developed significantly during the 1950s and 1960s due to the demand for high quality holidays. This led to the combined development of accommodation, infrastructure and leisure facilities, such as golf courses and marinas. This development is still very intensive today [1].

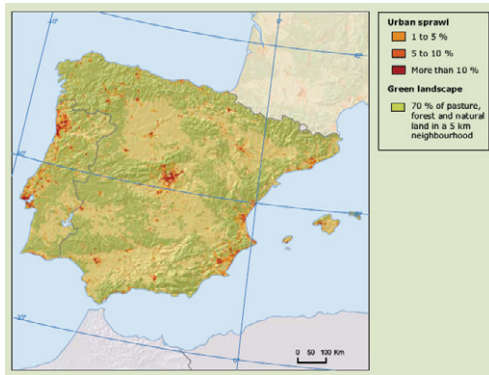


Fig. 2. Polarized urban sprawl around major cities and the coast of Portugal and Spain (1990-2000)

3.3. The sprawl in the Asia

Zanjan is one of the cities in Iran that have had a rapid expansion in recent years and vast areas of the city have been built up recently. Proposed residential area of Zanjan master plan was 967 Km² in 2000 that reached to 2417 Km² at its deadline. Findings show the expansion of the city has been affected by various factors such as economy, urban development plans, policies and different groups that have brought about the sprawl phenomenon to the this city. Areas in the central parts of the city have the least rating of sprawl and it gets aggravated by moving away from the center, so that the most sprawls is seen in eastern, northeastern and western parts of the city [16].

For the city of Beijing, exclusively losing farm land in the periphery and socio-spatial segregation happening in central urban area are main environmental and social problems being criticized as unsustainable and considered to great extend correlated to sprawl and intensification. Since the post-war reconstruction period in 1950s, Beijing as the capital city of China started to grow with a mono-centric urban structure, because the administrative centre of the city was located in the heart of the old city. The process of urban sprawl was accelerated, and the central urban area was enlarged from 109Km² in 1949 to 340Km² in 1978. Since 1990s, the phenomenon of urban expansion in the periphery became even more distinct, with the pattern that the central urban area grew rapidly along main arteries towards near suburban areas. In the past 40 years, land occupied because of expansion of the central urban area reached 520Km². Due to the extension of city proper, rural land was transformed into urban land uses, e.g. industrial, commercial or residential functions [17].

Surveying previous researches illustrate that urban sprawl phenomenon is an international issue and it has different aspects in any region. Regarding to this subject, we are trying to focus on the most important causes and results.

4. Causes of urban sprawl

As it was mentioned, sprawl has some characteristics that differs it from other kinds of urban growth and specialists have different viewpoints about its causes. Bruckner and Fansler studies in 40 United States urbanized areas in the US by surveying indicators such as agricultural land price, commuting expenditure, income, show that sprawl is a consequence that has gained over the time [18]. Rely on Miezkowski & Mills researches, urban sprawl is a consequence of income and population growth, transportation systems improvements, diversity in choice of users and competition for land. These are

natural indicators. Some other indicators such as high taxation, crimes, damaged infrastructures, numbers of educational centers have seen in central regions and reinforce urban sprawl [19]. A third theory of what may cause greater urban decentralization is based on what has been termed the “fiscalization of land use”. Bruckner believes that increasing in income and population and decreasing in commuting costs cause to sprawl. Increasing in population emerge the needs to space. From other point, by income growth, residents tend to bigger buildings and as a response to this problem, high ways and infrastructures will be built [3]. Land value is the other factors that has mentioned in studies [10]. From Ewing view point four factors cause to urban sprawl: consumer preference, technological innovation, subsidies and public and quasi- public goods [6].

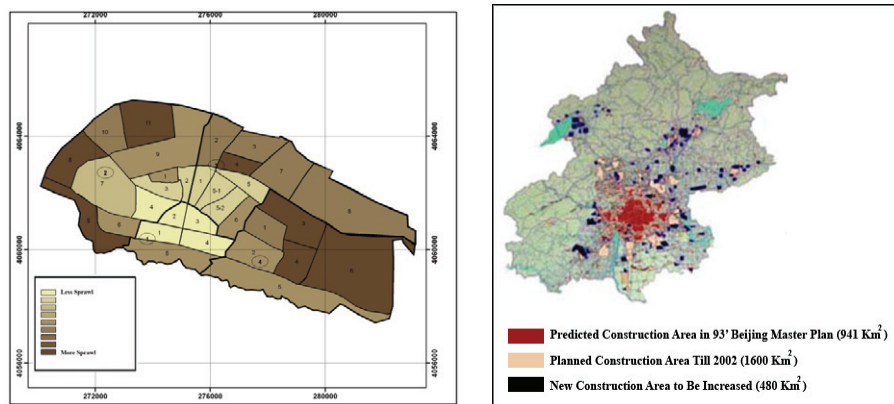


Fig. 3. (a) Urban sprawl in Zanjan city ;(b)Urban sprawl trend in different periods in Beijing

As a summarize, it has done many studies about causes of urban sprawl that the most important factors are population and income growth, low price of land and access to appropriate housing, some advantages such as low price of transportation systems, promotion of commuting network, new centers for job in suburbs, using infrastructures, subsidies and public services. These factors will cause to promotion of utilities and encourage residents to urban sprawl. Table (2) shows categorized factors.

Table 2. Urban sprawl causes

| Factors | Causes |
|---------------------|---|
| Economic | Economic growth and increasing income Price of land Subsidies |
| Demographic | Population growth |
| Housing | More space per person Diversity of choice |
| Transportation | Private car ownership Low commuting expenditure Transportation systems improvement Availability of roads |
| Inner city problems | High levels of taxation Damaged infrastructures Less numbers of public centers Small apartments Lack of open space Social problems |
| other | Technological innovation, public facilities and infrastructures |

5. Results of urban sprawl

After surveying characteristics and causes of urban sprawl, we will consider the positive and negative results of this phenomenon. Regardless of positive aspects of urban sprawl, most of the viewpoints consider on negative results. Part of these refers to core-area problems. We can mention to issues such as concentration of poverty, low quality of educational centers and shortage of financial resources [2]. In transportation, sprawl cause to more commuting, long travels and more congestion. Households are able to pass more distances to access to better housing, educational centers and job and it intensify by access to infrastructures [4]. Sprawl increases the cost of infrastructures. We can mention to some examples such as high ways, parking, water, electricity costs. In addition, it will cause to usage more energy, emergence of pollution and removing lands. Living in these regions also has many psychic and social costs. We can identify two types of psychic costs: deprivation of access and environmental deprivation [6]. Finally, we can claim that sprawl has different results in three levels of cities, new districts and metropolitan areas. Sprawl effect old centers and cities by creation of new problems that cause to missing competitive power. In new districts, it causes to preparing new infrastructures, generating more travels, removing agricultural land and reduction of social interactions. Third level of results that effect metropolitan areas are increasing infrastructure costs, damaging to environmental resources, using more energy and increasing pollution.

6. Policies and method for controlling urban sprawl

According to the negative results of urban sprawl, it is necessary to develop policies to decrease its negative effects. There are many policies that each one concentrates on different aspect of this issue.

- Control travels: Surveys shows that reducing the number of private auto ownership is one of the main methods for controlling sprawl. More taxation and toll gate is the other solution.
- Create urban boundaries: Urban boundaries in edges of cities will control urban sprawl. In this regard, only constructing in inner districts will be allowed and urban size will not be extended.
- Participate in providing infrastructure costs: Surveys show that urban sprawl has got costs 20 times more than the normal growth because of needs to news ways, schools, housing and public services [2]. So increasing resident's share of costs plays an important role in controlling sprawl.
- Betterment of low-income household's living conditions: One important part of residents in suburb is people who migrate for improvement of their family life. Paying financial credits, preparation of affordable housing and regional subsidies are some solutions for improving their living condition.
- Redevelopment of inner-core regions: This action causes an increase in urban land price. Usage of lands and enterprising in industrial abandoned lands, blank commercial plots and metro stations spaces, rehabilitation of abandoned properties and historic buildings are some examples of this policy.
- Control growth and protection of lands: Open spaces have high value tax determination for changing land uses causes a decrease in the rate of land changes.
- Urban consolidation: Urban consolidation has been introduced as a solution for more appropriate utilization of lands and infrastructures in the built up area of a city. It pursuits restriction of using urban lands, reduction of infrastructure costs, and using of more public transportation.
- Support smart growth strategies: Smart growth concentrate on compact development and redevelopment built up area in a city.
- Creative and efficient management: presenting creative urban policies will cause an appropriate growth. So, planners should be able to determine value and direction of development and its costs.

7. Conclusion

In this research by surveying urban sprawl characteristics and definitions, we introduced this phenomenon. After this step, by surveying literatures, we expressed its causes. According to results, main causes to emersion this phenomenon are: population and income growth, low price of lands, access to appropriate housing and low costs of infrastructures and transportation. But regardless of positive results of urban sprawl, this issue finally leads to some problems in cities, new districts and urban regions that we can mention to decline in inner city, traffic and congestion, long travels, increase in infrastructure costs and reduction of environment quality and social interactions. Therefore, according to these problems we should utilize suitable policies. Participate in providing infrastructure costs, control travels, create urban boundaries, redevelopment of inner-core regions, support smart growth strategies, increase density and create compact city, strength the role of local authorities and efficient management are examples that can be used as suitable policies for stated problem. At the end, over mentioned points we have to indicate that regardless of proposed policies, there is no unique solution for this issue and it needs more researches in different aspects. Moreover, according to the regions and cities characteristics, we might do policy making and apply appropriate solutions to control urban sprawl. The role of urban policies, private sectors, urban authorities and planners in this trend are some important subjects that have been ignored in most of surveyed studies and therefore they need to be further researched.

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