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The Value-Creation Role Of Accessibility Through The Critical Realism Method: Istanbul Bus Rapid Transit System

Erişilebilirliğin Değer Yaratmadaki Rolünün Eleştirel Gerçekçilik Yöntemi ile İrdelenmesi: İstanbul Metrobüs Sistemi

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ABSTRACT
Public investments in "mass transit systems" provide an equal right of accessibility economic and social opportunities for everyone. Concurrently, they generate an increase in land value both along the mass transit line and within the accessible area of the stations. This article focuses on the socio-economic and spatial effects of the increased land value resulting from the accessibility created by the mass transit system. By reviewing world wide case studies and practices, it examines these causal processes within the framework of the Critical Realism Method using the example of the Istanbul Bus Rapid Transit (BRT) System. As a result of the Extensive Analysis, an analytical method of the Critical Realism Method, it was observed that the rate of land value increase in the Istanbul BRT System was 28% and the rate of land value increase at all stations along the line varied between 20% and 280%. In the Intensive Analysis, it was observed that the increase in land value at selected stations varied depending on the proximity of the station to Istanbul's Central Business District, new incoming land use types, plan changes made by the public, the presence of vacant lands that would enable land speculation, and the presence of large projects around the station. This article provides insights which explains that "the change in land value resulting from accessibility" does not cause the same magnitude of value increase at every station along the line and does not create the same socio-economic and spatial impact at every station. It presents an empirically tested study by comparing the accessibility created by the Istanbul BRT System before and after its implementation.

Keywords: Accessibility, Land Value, Critical Realizm, Relational Stratification Model, İstanbul Bus Rapid Transit (BRT) System

ÖZ
Kamu yatırımdan "toplu taşıma sistemleri", herkese/her kesime yönelik ekonomik ve sosyal fırsatlara eşit erişilebilme hakkı sunarken, hem toplu taşıma sistemi hattı boyunca hem de durağın erişilebilir alanında arazi değer artışına sebep olmaktadır. Bu makale toplu taşıma sisteminin yarattığı erişilebilirlik sonucunda oluşan arazi değer artışının sosyo-ekonomik ve mekânsal etkilerine odaklanırken, dünyada yapılan çalışma ve uygulamalara bakarak bu etkilerin nedensel süreçlerini, İstanbul Metrobüs Sistemi örneğinde Eleştirel Gerçekçilik Yöntemi çerçevesinde incelemektedir. Eleştirel Gerçekçilik Yönteminin analiz metotlarından Yaygın Analiz sonucunda İstanbul Metrobüs Sisteminde arazi değer artış oranının yüzde 28 olduğu, hat boyunca bulunan tüm duraklardaki arazi değer artış oranın ise yüzde 20 ile yüzde 280 arasında değiştiği görülmüştür. Derinlemesine Analizde ise Yaygın Analiz sonucundan çıkan veriler ışığında seçilen duraklarda arazi değer artışının, durağın Merkezi İş Alanına olan yakınlığına, durağın erişilebilir alanında yer seçen arazi kullanım türlerine ve büyük projelerin varlığına, kamu tarafından yapılan plan değişikliklerine, arsa spekülasyonuna sebep olacak boş arazilerin varlığına bağlı olarak değiştiği gözlemlenmiştir. Bu makale, erişilebilirlik sonucunda meydana gelen arazi değer değişiminin, hat boyunca her durakta aynı büyüklükte değer artışına sebep olmadığını ve her durakta aynı şekilde sosyal, ekonomik ve mekânsal etki yaratmadığına dair ip uçları verirken, İstanbul Metrobüs Sisteminin yarattığı erişilebilirliğin metrobüs sistemi faaliyete geçmeden önce ve faaliyete geçtikten sonrasını karşılaştırarak ampirik olarak sınanan bir çalışma ortaya koymaktadır.

Anahtar Kelimeler: Erişilebilirlik, Arazi Değeri, Eleştirel Gerçekçilik, İlişkisel Katmanlaştırma Modeli, İstanbul Metrobüs Sistemi

INTRODUCTION:

In today's metropolitan cities' transportation planning, there's a shift from a "mobility-centric" perspective to an "accessibility-centric" perspective. The underlying reason of this shift is from "mobility-centric" view's automobile-focused transportation planning prioritization to, the "accessibility-centric" perspective's placing humans at its core, advocating for more accessible spaces and land-use types. This approach seeks to address socio-economic and spatial impacts in a broader spectrum, aiming to popularize investments in mass transit systems (Bannister, 1995; Rodriguez et al., 2006; Litman, 2011; Mavao et al., 2012; Blackwell, 2017). Investments in public transportation systems which provide accessibility are essential from a planning standpoint, ensuring public benefit and granting the right of accessibility arising from the principle of equality for all income groups. Public investments in mass transit systems, which are made with the intent of distributing equal accessibility rights to society, primarily provide accessibility opportunities and then by time they create planned/unplanned spatial effects leading to an increase in land value after their introduction to the system (Ünver, 2021).

This article has two purposes, contributing to the discussion on the relationship between accessibility and changes in land value by presenting literature (Frizzell, 1979; Capozza and Helsley,1989; Macmillan, 2006; Harsman and Quigley, 1991; Fujita, 1989; Ünver, 2021; Tekeli, 1992; Kılınçaslan, 2002; Weisbrod and Reno, 2009; Geltner and Miller, 2000; Litman, 2011) and elucidating how this relationship has been addressed in world wide case studies and applications. The chosen field study, the Istanbul BRT System, merits investigation due to the palpable rapid fluctuations in land value increase, attributable to the system's "implementation style", its "position within the macroform of Istanbul", and its "unique features". This examination has been conducted through Extensive and Intensive Analysis of the Critical Realism Method, looking at the timing of value increase both in the overall Istanbul BRT System (Extensive Analysis) and within accessible areas of the stations (Intensive Analysis). The aim was to observe value changes before and after the BRT's inauguration. These analyses first employed the Relational Stratification Model and subsequent to the outcomes from this model, field observations and interviews were conducted. This investigation was empirically tested within the analysis of the Critical Realism Method, using both quantitative and qualitative data. The findings derived from this examination are discussed in the article's concluding section.

1. The Relationship Between Accessibility and Land Value Change

The concept of accessibility is defined as the benefit (Hansen, 1959; Davis and Lifchez, 1987; Ping, 2005; Martellato et al. 1998) obtained by the ease of access to a certain land use type from a certain location using a certain transportation system (Dalvi and Martin, 1976; Breheny, 1978; Geurs and Ritsema Van Eck, 2001; Cascetta et al., 2013; Van Wee et al., 2001; Ross, 2000; Tümertekin, 1976) and the benefits derived from it (Leonardi, 1978; Ben Akiva and Lerman, 1979; Burns, 1979; Greene and Liu, 1988; Banister and Berechman, 2000), which turns the interaction potential of a location into an opportunity (Leonardi, 1978; Ben Akiva and Lerman, 1979; Burns, 1979; Greene and Liu, 1988; Banister and Berechman, 2000). The modern approach to accessibility, under the framework of accessibility perspective (Litman, 2011), addresses a broader range of effects and options that accessibility provides for land value changes through accessibility indices (Bhat et al., 2001; Geurs and Van Wee, 2004) and accessibility-based analyses (Litman, 2003; Litman, 2011). It proposes accessible spaces and land-use types for the general benefit of society.

The concept of land value is defined as a result of economic and social activities organized within and around the city, incorporating the attributes of the land due to its location and the qualities of land-use types (Frizzell, 1979; Kılınçaslan, 2002), its accessibility value (Capozza and Helsley,1989), exchange value, use value, social value, environmental value and cultural value (Macmillan, 2006; Tekeli, 2009).

The concepts of accessibility and land value were first used together in 1926 in Robert M. Haing's discussion on "spatial friction cost" (Harsman and Quigley, 1991; Fujita, 1989; Kılınçlaslan, 1995). This discussion related “the increase in land value” to “the reduction in transportation costs and spatial friction costs” brought by transportation investments. The theoretical urban economics studies initially linked the change in land value to the accessibility provided by the transportation investments in the Monocentric City Model developed by Alonso (1964), Muth (1969) and Mills (1972), emphasizing the significant impact of urban rent and/or the urban rent curve on changes in commuting times between home and work (Ünver, 2021).

The relationship between increased land value and accessibility provided by transportation investments is encountered in urban rent discussions as "accessibility rent" and "location rent" (Tekeli, 1992; Kılınçaslan, 2002). In accessibility rent, there's an inverse relationship between rent and transportation costs. The total rent and transportation expenses paid by urban residents are equal, and the "accessibility rent" received by the landowner naturally arises parallel to the city's growth and the development of the transportation system without any contribution from the landowner (Tekeli, 1992). This has an impact on the increase in land value. In location rent, transportation plays a crucial role in generating rent due to the land's location. The landowner does not intervene in the formation of this rent; it's created over time through accessibility provided by transportation investments and subsequent new types of land use (Kılınçaslan, 2002). Investments in public transportation systems play a significant role in the formation of accessibility and location rents. These rents affect both along the public transport route and within the accessible area of the station. The location and accessibility provided by the public transport route, and the location and increased accessibility of the stations, lead to an increase in land value. The arrival of new types of land uses looking to benefit from this accessibility further fluctuates urban rent.

The land value change that occurs as a result of the accessibility provided by the public transport system, is also defined as "value capture" (Un-Habitat, 2013). It highlights the economic effects of new land use types looking to benefit from the increasing level of accessibility, which cause an increase in sales and rental prices as a result of increasing land value. Therefore, recent studies have emphasized the importance of measuring the economic effects of the public transportation system in advance in the decision-making process where the public transportation system will be built (Ünver, 2021; Cambridge Systematics Inc., 1998; Weisbrod and Reno, 2009). It's crucial to foresee in advance what kind of effects the economic impact that emerges from the accessibility provided by the public transportation system will have on urban development. Understanding the spatial characteristics of the city (size, population density, land-use type, income distribution, etc.), planning decisions, the presence of vacant lands, the research of possible new land-use types and the factors that will lead to an increase in land value will offer significant advantages (Geltner and Miller, 2000).

Effects related to land value changes along the public transportation system route also create spatial, social, and economic impacts within the accessible area of station. Stations are defined as "nodal points" (Ünver, 2013), "flows (areas of places)" (Castells, 1989), and "geography of networks (geography of areas)" by Dematteis (1988). Stations, with their pedestrian density (activity tracks), morphological structure, road network design, and tiering, create a potential value. They form an attractive environment for emerging areas, increasing land value in their accessible area, creating a unique region.

2. World Examples in the Relationship Between Accessibility and Land Value Alterations

There are many studies and practices related to accessibility and land value change. This section summarizes the studies on accessibility and land value change, by presenting a table of example studies conducted up to now, and provides impressions on what topics are generally studied in this field. Accessibility and land value change application examples provide information on the social, economic and spatial impacts of the BRT System, based on successful examples of BRT Systems implemented world wide.

2.1. Studies Conducted World Wide on the Correlation Between Accessibility and Land Value Shifts

There're numerous studies which have attempted to explain the reasons behind the effect of accessibility on land value changesup to now. These studies are examined as those focusing on the Bus Rapid Transit (BRT) System and as those outside of the BRT System.

Table 1. World wide studies on accessibility and land value change in public transit systems (Ünver, 2021)

Researcher	City (Country)	Type of Public Transportation System	Subject of the Research	Increase Rate
Dewees (1976)	Toronto (Canada)	metro	land value change	_
Giuliano (1986); Bajic (1983); Voith (1991)	ABD	metro	land value change	_
Grass (1992)	Washington (ABD)	metro	land value change	_
Laakso (1992)	Helsinki (Finland)	metro	land value change	0,11
McDonald ve Osuji (1995)	Chicago (ABD)	rail system	land value change	0,17
Chernih (2003)	Sydney (Australia)	train line	land value change	%1-2
Yankaya, (2005)	İzmir (Turkey)	train line	land value change	0,16
Debrezion (2006)	Holland	rail system	land value change	_
Cervero (2006)	San Diego (California)	rail system	land value change	0,17
Armstrong ve Rodriguez (2006)	Massachusetts (ABD)	rail system	land value change	0,1
Medda ve Modelewska (2009)	Warsaw(Poland)	rail system	land value change	0,07
Becker (2013)	Boston, Minneapolis-St. Paul, San Francisco, Phoenix, Chicago (ABD)	metro	housing sales value	%37-%129
Papon vd. (2015)	Paris (France)	rail system	housing sales value	%5'lik
Dai, Bai ve Xu (2016)	Beijing (China)	metro	housing sales value	_
Zhong ve Li (2016)	Los Angeles (ABD)	rail system	housing sales value	_
Mulley vd. (2018)	Sydney (Australia)	rail system	housing sales value	0,005
Sharma ve Newman (2018)	Bangalore (India)	metro	housing sales value	_
McMillen ve McDonald (2004)	Chicago (ABD)	rapid transit line	housing sales value	_
Xu ve Zhang (2016)	Wuhan (China)	metro	housing sales value	_
Rodriguez ve Targa, 2004	Bogota (Colombia)	BRT	housing sales value	%6,8- %9,3
Perdomo vd., 2007; Levinson vd., 2002; Perdomo, 2011	Bogota (Colombia)	BRT	housing sales value	0,22
Rodríguez ve Mojica 2009	Bogota (Colombia)	BRT	housing sales value	%13-%14
Munoz-Raskin, 2010	Bogota (Colombia)	BRT	housing sales value	0,087
Cervero ve Dai, 2014	Bogota (Colombia)	BRT	housing rental value	_
Rodriguez vd., 2016	Bogota (Colombia)	BRT	housing sales value	0,094
The New Real Estate Mantra: Location Near Public Transportation, 2013	Boston (ABD)	BRT	housing sales value	3,17
Suzuki vd., 2013	Seul (Korea)	BRT	housing sales value	%10-%25
Deng, Ma ve Nelson, 2016	Pekin (China)	BRT	housing sales value	0,014
Mulley ve Hong Tsai, 2016	Liverpool (England)	BRT	housing sales value	0,11
Garza, 2016	Barranquilla (Colombia)	BRT	land value change	_
Perk ve Catala, 2009	Pittsburgh'da (Pensilvania)	BRT	land value change	0,16
Dube vd., 2011	Quebec'de (Canada)	BRT	land value change	%3-7
Velandia, 2013; Flores Dewey, 2012	Ecatepec (Mexican)	BRT	land value change	0,15

When looking at the worldwide study examples related to non-BRT public transit systems focusing on accessibility and land value change, the first study dates back to 1976, focusing on the land value changes around rail system stations. Between 1976 and 1992, there were studies on the effects of rail systems on land value changes, such as their distance from the Central Business District, whereas from 1976 to 2009, there was an emphasis on studies focusing on land value changes around stations. The first study addressing the effect of planning decisions on land value changes was observed in 2004. After 2009, the focus shifted primarily towards the rise in housing prices. In 2015, for the first time, there was a study examining land value changes along the rail system line based on housing price increases. From 1976 to 2018, most studies were conducted on a station-scale basis, considering land value and home sale values. The rate of value increase identified in these studies ranged from 0.05% to 129%. When considering worldwide studies on the BRT System, accessibility and land value changes, the first study from 2002 looked at housing price increases due to land value surges around stations. The first data analysis on the impact of the BRT System on land value increase was conducted in 2004. Studies between 2002 and 2016 mostly evaluated the BRT System in terms of housing sales/rental value increase or land value surge. After the introduction of the BRT System, there was an observed average increase of 1.4% to 316% in the sales value of houses around the stations and land value increases along the BRT line averaged between 3% and 16%. Most research was based on the Bogota BRT System example, with a focus on land value changes occurring along the line, rather than at the station scale (Table 1) (Ünver, 2021). All these studies have proven that the case study discussed in the article is the first study to compare the land value change before the establishment of the BRT System with the land value change after its establishment, within the analysis of a method, and to analyze both along the line and at the station scale.

2.2. World Wide Practices Regarding the Relationship Between Accessibility and Land Value Changes

Several practices have been implemented along the BRT System line and at the accessible boundaries of stations, concerning the relationship between the BRT System's accessibility and land value changes. These practices are exemplary applications that redirect the land value changes resulting from the BRT System's enhanced accessibility for public benefit.

The most notable is the Curitiba example. By successfully integrating its BRT System into urban development, Curitiba has become one of the world's most sustainable and well-planned cities. This city is known for integrating its BRT and pedestrian access plans under the "accessibility and reachability" policy. Their system, which encompasses the main axis, two side blocks, and three main roads, is called the "tri-system". They've segregated the central avenue for BRT transit and local traffic accessing buildings and parking. Parallel streets facilitate higher-speed traffic flowing in one direction either towards the city center or the suburbs. Adjacent blocks have been zoned for mixed-use, high-density development, while blocks further from the tri-system are zoned for lower-density using the TOD System. Urban development has been linearly planned along structural axes. Linear parks have also been planned along the BRT axis, with pedestrian pathways and bike lanes ensuring direct connections to these parks (Macedo, 2013; Rabinovitch and Leitman, 1996; Smith and Raemaekers, 1998; Duarte and Ultramari, 2012; Wright, 2003; Suzuki et al., 2013; Lindau et al., 2010; Baker, 2011; Ünver, 2021).

The Guangzhou BRT System, on the other hand, has created a green corridor spanning hundreds of kilometers along the BRT line, connecting it to neighboring districts with bike and pedestrian paths. This has also rejuvenated social housing in these neighborhoods (Suzuki et al., 2013; Ünver, 2021).

The Ottawa BRT System is notable for promoting TOD with integrated pedestrian and bike paths around stations within a long-term master plan framework (Mullins et al., 1990; Ünver, 2021).

The Ho Chi Minh BRT System stands out for creating green and public spaces that better integrate neighborhoods and provide improved pedestrian access under the TOD framework (Moffat et al.,2012; Ünver, 2021).

The Ahmedabad BRT System exemplifies creating public spaces integrated with neighborhoods and stations, involving non-governmental organizations in the process (Suzuki et al., 2013; Ünver, 2021).

The Qingdao BRT System is noted for its "eco-block" concept, creating a sustainable neighborhood within walking distance of a BRT station (Fraker, 2008; Ünver, 2021).

3. Study Area: Istanbul BRT System

The relationship between the accessibility provided by a public transport system and the associated increase in property value will be analyzed using the case study of Istanbul’s BRT System.

Three primary reasons led to the selection of the Istanbul BRT System as the study area:

1. ***Implementation Style of the Istanbul BRT System:*** The Istanbul BRT System was rapidly deployed without comprehensive planning to alleviate the traffic congestion caused by buses and minibuses on the D100 highway (Figure 1). This immediate action led to an instant appreciation of land values along the BRT route and its stations. However, the socio-economic and spatial impact of this value increase wasn't anticipated.

Figure 1. Istanbul BRT System

2. ***Position of the BRT Line in Istanbul's Macroform:*** The line of the Istanbul BRT System is located on the D100 highway, which is the most critical corridor in Istanbul's macroform. Serving neighborhoods with the highest population density throughout Istanbul (Figure 2), it ensures connectivity among various land-use types (residential, commercial, residential+ commercial, shopping center, business center, hotel, courthouse, large and small industrial areas, culture and congress center, private university, private hospital, private student dormitory, etc.) along its route (Figure 3).

Figure 2. Population density of the neighborhoods through which the Istanbul BRT Sytem line passes (Ünver, 2021)

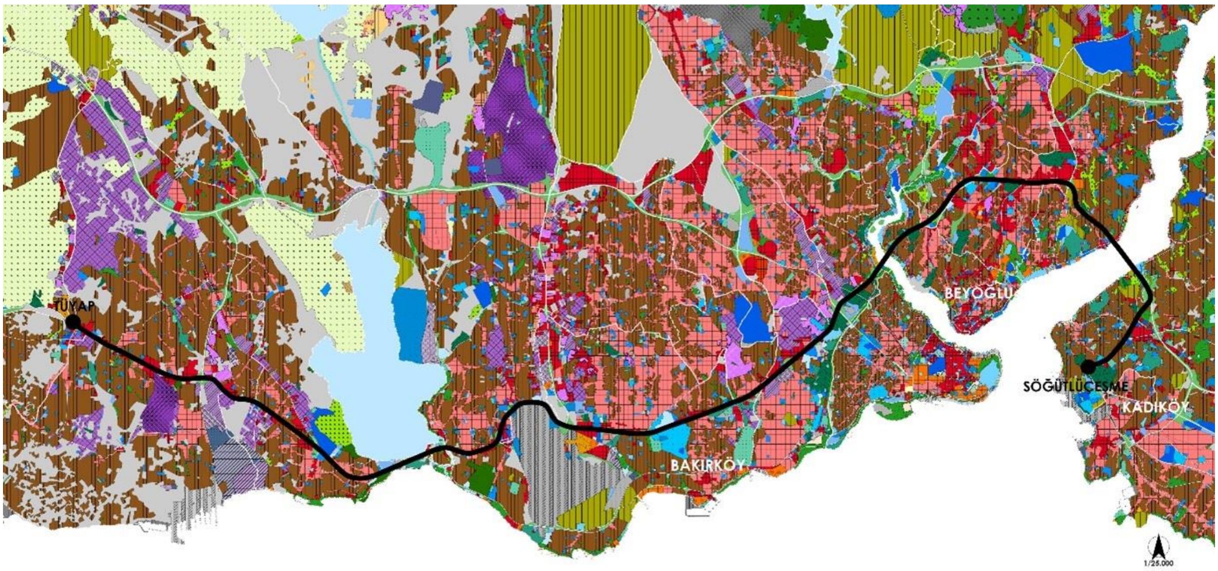


Figure 3. Types of land use found on the Istanbul BRT System line (Ünver, 2021)

Notably, it is the first intercontinental BRT System, being the sole line providing passengers from both the Asian and European sides access to Istanbul's Central Business District. Due to its strategic location, it accelerates the commute between the European side's Central Business District and secondary hubs and the residential areas on the Asian side (Figure 4).

Figure 4. Istanbul's Central Business Area, 1st Central Area and 2nd Central Area through which the Istanbul BRT System passes (Ünver, 2021)

3. ***Unique Features of the BRT System:*** The Istanbul BRT System, Turkey's first example and known worldwide as the first intercontinental BRT System, was retrofitted on the Bosporus bridge, considerably reducing the commuting time between work and home for passengers from both continents. The speed of the BRT reduces travel time, and when compared to other public transportation systems, it is cost-effective, swiftly operational, meets high passenger demand and offers a low ticket price (Buran, 2013). Serving all day, it carries more passengers in Istanbul than rail systems. Compared to other public transportation types, it increases walkability, integrating seamlessly with pedestrian paths, bike lanes, green spaces, public areas, residential and commercial zones, and various land-use types along its route, thereby enhancing accessibility in the vicinity of the stations (Ünver, 2021).

The aspects of "Implementation Style", "Position in Istanbul's Macroform", and "Unique Features" contribute to the pronounced and immediate impact of the accessibility provided by the Istanbul BRT System on the fluctuating property values along its route and in the accessible areas surrounding its stations.

4. The Methodology of the Study: Critical Realism

The methodology adopted for this study is Critical Realism. The reason for selecting the Critical Realism Method is due to its approach on observed and unobserved mechanisms possessing causal powers within a structural and historical context (Ashworth et al., 1990).

It acknowledges the existence of structures that need discovery, along with their associated powers and offers a comprehensive structural analysis (Bhaskar, 1975; 1996; Sayer, 1992). It aims to explain spatial differences by studying interactions of structures that emerged in different time/space contexts (Erendil-Türkün, 1998). Consequently, it has been found to be the most appropriate method to study the impact of the accessibility provided by the Istanbul BRT System on land value changes, examining the system's interactions with structures before and after the BRT System was implemented. Based on this, the Extensive Analysis and Intensive Analysis, which constitute the analysis stages of the Critical Realism Method mentioned in Sayer's "Method in Social Science" have been employed.

The Extensive Analysis focuses on discovering common features and general patterns of an entire area. It reads information about the entire system, following a research strategy that is not in-depth (intensive) but covers all events. Its analysis consist of descriptive and inferential statistics and large-scale formal analysis of numerical data (Sayer, 1992). Using this method, the land value changes along the Istanbul BRT line were read by looking at all stations on the BRT route through statistical and numerical analysis.

The numerical analysis used here employs the “Relational Stratification Model.” This model is an analysis method that uses the exploratory analysis methods of “Correspondence Analysis” and “Cluster Analysis” in conjunction (Ünver, 2021). It offers an analysis based on relational resolution, revealing meaningful relationships, similarities, and differences between variables (Ünlü-Yücesoy and Güvenç, 2010; Ünlü-Yücesoy, 2014).

In this analysis, data on 16,300 land values for the years 2005-2015 of 1,630 streets that enter the boundaries of 18 districts and 83 neighborhoods within the accessibility distance of the stations on the Istanbul BRT System route were used. With the Relational Stratification Model, 16,300 data were clustered, and “Standardization (St)” was performed by converting them to index values for the formation of street groups (clusters).

Standardization is done through the formula “St: (Xi-X) / S”.

Xi: The value you observe
X: The average land value of that year
S: The standard deviation calculated over the distribution of land values of that year

The value obtained as a result of standardization; if a negative number comes out, it means that the value is much lower than the average land value of that year, if the number is zero, it means that the value is very close to the average land value of that year, if a positive number comes out, it means that the value is much higher than the average land value of that year.

The street clusters (groups) that emerge in relation to these values;

- Comparing each street with all other streets examined,
- Determining the streets that experience similar land value increases or land value decreases over time,
- Normalizing over the maximum value, finding which streets are at the maximum land value,
- Revealing the street groups (clusters) that are similar in value,
- Providing information on which district, neighborhood and station the streets that stand out in terms of land value increase affect (Ünver, 2021).

The results showed whether the observed land value was far below, close to, or far above the annual average land value. These results helped identifying and clustering the streets with similar land value increases or decreases over time and those with maximum land values. The resulting street clusters were displayed on maps generated in GIS for easy interpretation in Extensive Analysis. These maps illustrate where the greatest land value changes occurred along the BRT line, both before and after its implementation. Additionally, graphs showing the “Annual Average Land Value Increase Rate” were created from the 16,300 data points. By interpreting these graphs and maps, sample stations were selected for in-depth study in the Intensive Analysis to understand the detailed reasons for the land value increase. For instance, three stations, where the BRT System had the most significant impact on land value increases, were chosen. These are the "Halıcıoğlu Station" in Istanbul's Central Business Area (CBA), the "Cennet Mahallesi Station" in the 1st Central Area (M1), and the "Beylikdüzü Station" on the periphery of Istanbul and in the 2nd Central Area (M2) (see Figure 4).

The Intensive Analysis was used at these three selected stations. It focused on understanding how the causal process works, emphasizing events with structural or causal connections, using participant observation and interactive interviews as part of the qualitative field research's "insider understanding" method (Sayer, 1992). Two paths were followed; the first path, "accessibility relationship" aimed to understand the relationship between streets with increased values and their accessibility to the station, observing the ease or difficulty of morphological access to the station and examining the pedestrian density (activity traces) to query the relationship between easy accessibility and land value changes. The second path, "value change relationship" involved interviews with realtors and local community leaders to understand whether new types of land uses had chosen those streets after the BRT arrived, and if any planning changes and/or urban transformation projects that could affect the value increase had been implemented.

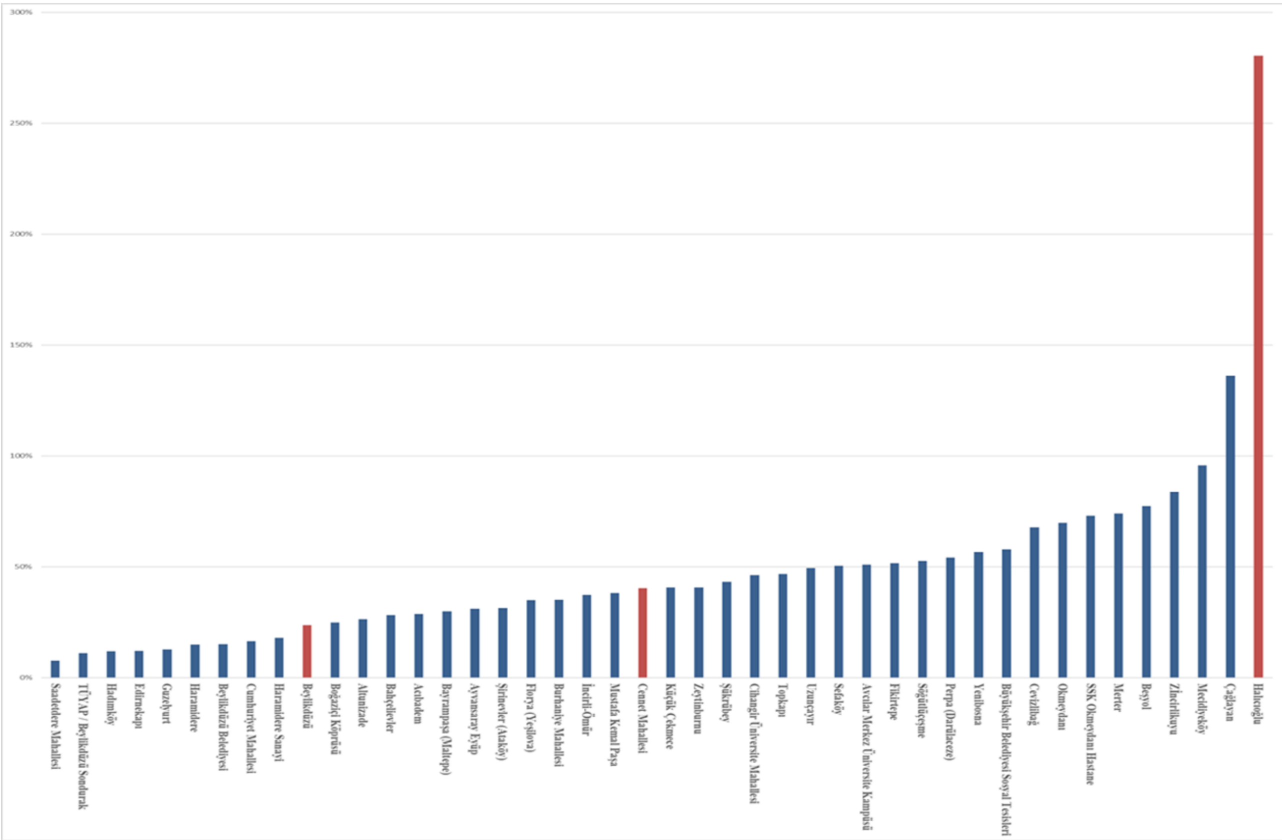
5. Findings of the Study

This paper's primary argument is the increase in land value resulting from the accessibility provided by the public transportation system creates different socio-economic and spatial effects at each station. The Critical Realism Method used for analyzing these effects provides Extensive and Intensive Analysis in the Istanbul BRT System case, revealing the processes of these varied impacts, the relations among structures and the story of change at each station.

The Extensive Analysis of Critical Realism Method, through its relational stratification model concerning all stations along the Istanbul BRT line, reveals that the BRT System caused an immediate increase in land value upon its introduction in 2007 with the most significant increase occurring between 2005-2010. It was observed that the increase in land value was not uniform at all stations along the BRT System’s line and not every station was affected in the same socio-economical and spatial way. This differentiation provides clues about how the urban transformation process evolved along the line after the BRT System's introduction.

The most important reason for the land value increase is that the Istanbul BRT System passes through the main backbone (see Figure 2-3-4) of the Istanbul macroform and connects Istanbul's Central Business Area, 1st Central Area and 2nd Central Area and thereby reduces the distance between home and work between two continents. This increase has highlighted the previously known socio-economic and spatial division between the north and south of the Istanbul macroform, which became more clearly defined after the BRT line was introduced (Ataköy, Şirinevler, Cennet Mahallesi stations). This study indicates that the social class, previously existing and more clearly defined with the introduction of the BRT System, meets again at the BRT station, dividing the area into north and south.

Additionally, it was found that the rate of land value increase in the Istanbul BRT System was 28%, while the rate of land value increase at all stations along the line varied between 20% and 280%. Along with the increase in land value, changes have occurred in land use types through public and private sector intervention after the arrival of the Istanbul BRT System. These land use types generally include Çağlayan Courthouse, Haliç Culture and Congress Center, Fikirtepe Urban Transformation Project, Zorlu Center AVM, Trump AVM, Torun Center, private universities, private hospitals, shopping centers, hotels, office buildings, luxury residences, private student houses, and a private museum.



Graph 1 The annual average land value increase rate from the year the Istanbul BRT System stations opened until 2015 (Ünver, 2021)

Looking at the rate of land value increase for all stations along the Istanbul BRT System's line, it is seen that the highest increase rates occurred at Halıcıoğlu, Çağlayan, Mecidiyeköy and Zincirlikuyu stations. The least land value increase was observed at stations located near large industrial areas, cemeteries, and multi-level intersections (Graph 1).

The Extensive Analysis provides clues about which stations and streets were most affected by the value increase, while the Intensive Analysis shows that each station has its unique story. With the Intensive Analysis it is observed that the accessible area of the station has been reshaped socio-economically and spatially with the initiation of the BRT System. The land use types that choose the location after the BRT System comes create a multiplier effect with the value increase. As a result, while there is an increase in house rents, those who can afford the rent continue to live in this area, while those who cannot are forced to move. This indicates that the increase in accessibility in the city benefits some social classes while disadvantaging others.

Based on comprehensive analysis, the key findings from an Intensive Analysis of the three selected stations are:

- After the initiation of the Istanbul BRT System, the Halıcıoğlu Station experienced the most significant land value appreciation (see Graph 1). This was attributed not only to the accessibility provided by the BRT System but also to the concurrent designation of the Halıcıoğlu area as the Beyoğlu Culture Zone and the media coverage about the impending Haliç Port Project. It's noteworthy that after the BRT was introduced, the Beyoğlu Courthouse in Halıcıoğlu was moved to Çağlayan and was replaced by the FSM University, illustrating a significant shift from public service use to educational use. The accessibility and value increase due to the BRT System haven't been returned to the public. Moreover, the inauguration of the Haliç Cultural and Congress Center further augmented the land value. Also, due to its proximity to Istanbul's Central Business District, easy access to Çağlayan Courthouse, and the presence of private universities, Halıcıoğlu Station had the most user turnover post-BRT implementation compared to Cennet Mahallesi and Beylikdüzü Stations (Ünver, 2021).

- After the initiation of the Istanbul BRT System, the Cennet Mahallesi Station witnessed a shift from being a health facility in city plans to a residential and commercial area. This led to not just street-level but broader regional land value appreciation. The value increase, resulting from the BRT a public project was turned into private gain via urban planning, thus failing to benefit the larger public (Ünver, 2021).

- The Beylikdüzü Station, post news of BRT extension, saw speculation-driven land acquisition. Through plan adjustments, luxury housing and commercial zones were established, enabling specific users to profit from increased accessibility and land value (Ünver, 2021).

CONCLUSION:

"Public transportation system investments", which are one of the basic issues of planning, are important in terms of granting the right of accessibility that arises from the principle of equality for all income groups, by considering the public benefit. Public transportation systems, which the public makes to distribute equal accessibility rights to the society, provide accessibility opportunities on the one hand, and on the other hand, create planned/unplanned social, economic and spatial impacts in the places over time after the public transportation system is installed, causing changes in land values and land use types. The new land use types that want to benefit from the benefit provided by accessibility accelerate the value increase even more. This article is important for revealing the social, economic and spatial impacts of the value increase that occurs as a result of the accessibility provided by the BRT System, through the example of the Istanbul BRT System.

The findings and recommendations related to these findings that emerged as a result of the Critical Realism Method used in the study are as follows;

- It is seen that the public cannot foresee this value creation process that it creates by planning or not planning, and that this value is not transferred back to the public as social, economic and spatial value.

- It is seen that the value increase that arises due to accessibility increases with the plan revisions made by the public after the public transportation system arrives and/or after it is planned, and the new land use types that the private sector chooses.

- While the value increase is experienced, due to the increase in accessibility to housing (real estate), an increase is observed in housing (real estate) sales prices and housing (real estate) rents, and as a result, user change occurs.

Accordingly, it is important to turn the value creation process into an opportunity in the direction of the public as social, economic and spatial value. For this, policies related to the taxation system for value increase (rent) can be restructured and economic value can be created. In this regard, examples applied in countries such as China, Hong Kong, America, Denmark, Estonia, New Zealand, Australia, Germany and Switzerland can be looked at regarding the taxation of public rent that occurs in the urban planning process. In addition, it is very important to identify the large property parcels and vacant lands that may be subject to land speculation around the stations before the public transportation system arrives. It is very important to ensure the return of the value increase that will occur in these areas to the public as social, economic and spatial. For this, an integrated system with the city should be established as in the examples of Curitiba, Guangzhou, Ottawa, Ho Chi Minh, Ahmedabad and Qingdao BRT Systems, and public spaces should be created with usage areas such as pedestrian areas, bicycle paths, green axes, etc. that will increase accessibility to the station with the participation of the public.

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