

# A Framework for Increasing Sustainability in Affordable Housing: Case Studies in Turkey

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## Abstract

The concentration of city populations profoundly impacts the environment and human well-being, posing massive sustainability challenges related to affordable housing and its infrastructure. Turkish cities are part of this global trend resulting in new aspirations for affordable and rapidly built public housing, including those created since 2003 by the Mass Housing Development Administration (TOKI).

A major challenge for affordable housing in developing countries, such as Turkey, is the lack of a holistic and viable sustainability framework for use in their creation. Currently, empirical case studies of successful housing projects and city design and planning literature provide a rich source of background data on affordable housing strategies, yet a detailed set of urban sustainability indicators are neither well defined nor integrated. The primary goal of this article is to articulate the components of economic, environmental, and social sustainability (e.g. land-use, energy use, design process, accessibility, density, affordability), while outlining a set of guidelines for affordable housing that can be operationalized by agencies fostering a more sustainable quality of life, such as TOKI. The article begins with a review of literature to identify sustainability indicators applicable to low-income residential environments, then examines two TOKI housing projects in Turkish cities, Bursa and Amasya.

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## Introduction

During the United Nations Conference on Housing and Sustainable Urban Development in 2016, world leaders announced that population in the world's cities is expected to nearly double by 2050, making urbanization one of this century's most fundamental challenges (UN Habitat III, 2016). They also stated that as city populations increase, so do impacts on environment and human welfare due to socio-economic, cultural and economic activities, which pose immense sustainability concerns in terms of housing, infrastructure, basic services, food security, health, education, and so forth. A decade earlier, at the UN Habitat II (UNCHS, 2006, p. 2) meeting in Istanbul, members declared their support for the right to adequate housing, protection from discrimination and equal access to affordable, sufficient housing for all persons and their families. Further, UN Habitat II (UNCHS, 2006) proclaimed the goal of creating affordable housing by "enabling markets to perform efficiently and in a socially and environmentally responsible manner."

This global trend is also seen in Turkish cities and has resulted in new aspirations for affordable and rapidly built public housing projects, including those by the Mass Housing Development Administration (TOKI) since 2003. In most cities in Turkey, there are economically, socially, and environmentally deteriorated neighborhoods and living areas, which lack identity and quality, and do not follow planned or orderly urbanization (Tas et al., 2014). The quality of urban life in most cities in the country must be improved and urban transformation activities should be carried out to create safe, resilient, and healthy living spaces for residents. To develop sustainable urban spaces, it is essential that true partnerships and involvement should exist among residents, planners and legal/institutional

agencies. Housing buildings and spaces must also be designed and built according to user needs, lifestyles, and local conditions (Tas et al., 2014). This includes the idea that neighborhoods should be built up from a hierarchy of human association with elements, such as the environment, the house, the street, the district, and the city with efficient mobility among these units (Jagadisan & Fookes, 2006). It is also important to understand that research and new knowledge about how communities develop should be holistic and transdisciplinary (Ibid, 2006).

The central government of Turkey has played a major role in urban renewal and neighborhood improvement projects under various regulations introduced after the 2000s. TOKI is responsible for housing production for low-income residents including the renewal of the housing stock in areas at risk of disaster. An examination of housing units produced by TOKI reveals that most of these developments followed a top-down planning process resulting in uniform housing types in almost every city including similar physical features (Tas et al., 2014; Bican, 2019). However, environmental issues, local qualities, physical characteristics, and cultural features should be taken into consideration, while closely examining the local conditions of the areas under transformation. Disregarding such features may lead to problems in the change of existing communities and in new housing zones, which are being considered for permanent housing development.

The design of the built environment, including its local, physical, and cultural characteristics can reinforce the sustainable lifestyles and social relationships among community members (Oktay, 2001). Housing is one of the most important building types that constitutes the built environment. At the Second United Nations Conference on Human Settlements, housing was defined as a social unit

supporting the individuals in the household and their relationships with other subjects in the society (Tas et al., 2014). It is also a physical unit allowing for realization of various functions necessary for integrity of life (Tas et al., 2014). Improving the spatial and social quality of life in the built environment from single building, to a neighborhood, and a citywide scale underlies sustainable development. Objective attributes that make up physical conditions affect each stage of the housing production process (i.e. planning, design, construction, and usage) influencing the subjective attributes that ultimately form a person's experiences in the environment.

This article examines the formal and spatial characteristics of four selected affordable housing projects in Turkey. The goal is to provide an initial review of the various components of sustainability, such as land-use, natural features, societal characteristics, accessibility, density, and affordability, and to outline a set of guidelines that can be utilized for further research and operationalized by agencies, such as TOKI. This study provides a background using the relevant literature and existing sustainability assessment strategies in the context of affordable housing. The four case study projects in this study are then reviewed using these initial indicators to evaluate their performance as both affordable and sustainable housing. The outcomes of case study evaluation, as well as a summary of the assessment framework, including the suggested additions and updates to the framework itself, are then discussed in detail. The article concludes with a summary of outcomes, their implications for practice, as well as the identification of future research opportunities.

## Background

Affordable housing has been a critical issue over the last several decades, especially where large and rapidly growing urban areas around the world have seen severe shortages in adequate and suitable housing (Özdemir Sari & Aksoy Khurami, 2018; Gan, et al., 2017; Muazu & Oktay 2011; Salama & Alshuwaikhat, 2006). Although a wide range of definitions have been suggested for affordable housing, the term generally refers to the provision of living accommodations for eligible households whose income is not adequate to acquire appropriate housing on the open market (Adabre & Chan, 2018; Gan, et al., 2017; Winston & Eastaway, 2008). Stone (2006, p. 151) states that "affordability expresses the challenge each household faces in balancing the cost of its actual or potential housing, on the one hand, and its non-housing expenditures, on the other, within the constraints of its income." One commonly used international definition refers to housing affordability as an assessment of expenditure on housing compared to income of the household (Gopalan & Venkataraman, 2015). In India for example, affordable housing is measured against a comparable criterion, such as income level of the family, the size of the dwelling unit, or affordability in terms of Equated Monthly Installment (EMI) quantity or ratio of house price to annual income (Gopalan & Venkataraman, 2015, p. 130). Three typical methods to examine affordability by comparing housing cost and household income are: 1) the ratio approach, using the ratio of housing cost to household income tested against a threshold level (often approximately 30%); 2) the residual income approach, looking at income remaining after

housing costs are deducted, usually tested against the poverty line; and 3) the subjective approach, using households' assessment of the incremental financial burden imposed on household income due to housing cost (Özdemir Sari & Aksoy Khurami, 2018; Pullen et al., 2010).

The goal of government affordable housing initiatives is generally to increase the availability of cost-effective housing for low-income groups (De Azevedo, Silva & Silva, 2010). Numerous government initiatives have been deployed for exactly this purpose around the world. However, studies disagree as to whether the affordability of housing has actually improved in the years following the implementation of these various programs (Been, Ellen & O'Regan, 2019; Fuhry & Wells, 2013; Isalou, Litman & Shahmoradi, 2014). Been, Ellen & O'Regan (2019, p. 25) argue theoretically and empirically that adding additional housing units does moderate price increases, and thereby encourages more affordable housing for low- and mid-income families. Other studies have concluded that economic viability cannot be considered alone in attempting to improve affordability (Mulliner, Smallbone & Maliene, 2013). For example, offering cost-controlled housing in new developments that do not consider location, access to retail, healthcare, and transportation can create situations where any cost savings in rent or mortgage payments are more than off-set by other increases in daily expenditures (Gan et al., 2017). Hamidi, Ewing, and Renne (2016) contend that the U.S. Department of Housing and Urban Development (HUD) rental assistance properties are affordable from the standpoint of direct housing cost, but do not have limitations on transportation costs. Therefore, in highly sprawling urban areas, transportation cost can easily exceed the 15% HUD ceiling, suggesting that location and hence transportation costs should be considered in developing new affordable housing.

Recent studies have concluded that a multidisciplinary approach to housing that is both affordable and sustainable presents a more comprehensive and inclusive route for attaining truly affordable housing (Gan, et al., 2017; Isalou, Litman & Shahmoradi, 2014; MacKillop, 2013; Salama & Alshuwaikhat, 2006). It has also been argued that using an integrated and comprehensive approach to affordable and sustainable housing development has the added advantage of reducing costs in other areas, such as energy bills, transportation, healthcare, work opportunities, life-cycle and maintenance expenditures, and so forth (Isalou, Litman & Shahmoradi, 2014; MacKillop, 2013).

## Sustainable Housing

As the idea of sustainable development gained prominence in the 1970s and 1980s, it was defined in the most general terms as "development that meets the needs of today without compromising the needs of future generations" (Gan et al., 2017; U.N. Habitat, 2012; WCED, 1987). The U.S. National Environmental Policy Act of 1969 also committed the United States to sustainability; establishing a national policy to develop and maintain conditions within which humans and nature can harmoniously and productively co-exist, thereby meeting our social, economic and other obligations to present and future

generations. Muazu & Oktay (2011, p. 109) suggest that the notion of sustainability has developed over the intervening years into a more holistic concept, linking goals such as “maintaining ecological integrity, meeting human needs for food, shelter and health and attaining social self-sufficiency and inter-generational equity.” In simple terms, this vision of sustainability and sustainable development requires integrated goals in the areas of environmental, social and economic performance (Pullen et al., 2010).

A fundamental social condition, such as housing, helps to determine the quality of life and welfare of people and places. The UN Habitat program (U.N. Habitat, 2012, p. 3) states that “where homes are located, how well designed and built, and how well they are [woven] into the environmental, social, cultural and economic fabric of communities are factors that, in a very real way, influence the daily lives of people, their health, security and wellbeing, and which, given the long life of dwellings as physical structures, affect both the present and future generations.” Singh & Pandey (2012, p. 6) promote the idea that “sustainable housing has the potential to produce good quality housing at a price that is affordable both in the short and long term.” The need for using sustainability standards for determining location and construction methods is paradoxically strongest in the affordable housing sector (Pullen et al., 2010, p. 48). This is due to the fact that increasing environmental standards can provide long-term economic benefits such as lowering transportation, maintenance and energy costs for the most economically vulnerable households (Wallbaum et al., 2012; Winston & Eastaway, 2008). Ecologically sustainable design has also been increasingly integrated into affordable housing due to the use of various financing tools such as the Low-Income Tax Credit in the U.S. Tax code (Fuhry & Wells, 2013).

The idea of combining sustainability and affordability within the same set of assessment parameters requires equitable, comparable and comprehensive performance levels in environmental, social and economic terms (Gan et al., 2017, p. 428). Mulliner et al. (2013, p. 270) state that sustainability and affordability are now commonly discussed mutually and interdependently. For example, incentives commonly exist to provide a percentage of affordable housing within sustainable communities, but also, to deliver minimum levels of sustainability within new affordable housing developments. Economic viability should not be the only consideration in assessing and improving housing affordability (Isalou et al., 2014; Mulliner et al., 2013). Instead, consideration of issues such as transportation density and routes, neighborhood environment, access to nutritious food and services, nearby employment opportunities, and so forth, should be included for a more complete picture of a viable affordable housing development. Integrating sustainability goals and assessment parameters into new affordable housing developments can thus offer improved long-term economic viability, both for the operation of the housing development, and for the economic and social sustainability of the residents.

## Assessment Strategies for Sustainable and Affordable Housing

One of the earliest comprehensive and holistic assessment frameworks for examining sustainable and affordable housing was completed for the Australian Housing and Urban Research Institute using a triple bottom line (TBL) strategy (Pullen et al., 2010, p. 51). For this framework, Blair et al. (2004) developed a triple bottom line strategy with seven themes that showed either a direct or indirect relationship to the social, economic or environmental general categories of sustainability and affordability. Within each of the seven themes, the authors provided a total of 37 weighted indicators to develop an assessment framework. The seven themes were; housing affordability, neighborhood and community, transportation, environment and biodiversity, energy, other environmental resources, and water / wastewater /storm water (Ibid, 2004, p. 36). Within each theme, such as affordability, the authors then provided measurable indicators such as median house prices and housing cost as a percentage of income.

In the years following the Australian study, researchers have suggested pursuing similar assessment categories, but with a broader and more transdisciplinary approach (Ibem & Azuh, 2011; Salama & Alshuwaikhat, 2006). After recognizing some of the limitations of the TBL strategy used in the Blair et al. (2004) study, Pullen et al. (2010, p. 54) pursued a systems thinking approach, recognizing that the component parts of any complex system, such as sustainability, can be best understood through the interconnected relationships with other factors and with other related systems, rather than in isolation. The Pullen et al. (2010) study developed nine general assessment categories, with 29 indicators. The categories included efficiency in water and energy, construction materials and methods, financial procurement, affordability of rent or purchase, dwelling size, appropriate density, adaptability, social acceptability, and desirability. In addition to a more holistic systems thinking approach and mixture of indicator measurements, the authors also added several useful factors to the assessment strategy that are of interest in this study, such as a consideration of construction materials and methods, universal design principles as a form of adaptability, social acceptance to the surrounding communities, and the idea of measuring desirability in some form. Over the last decade, studies have also suggested enhancing assessment frameworks by integrating both qualitative and quantitative strategies for each indicator (Adabre & Chan, 2018), by utilizing quantifiable success factors (Oyebanji et al., 2017), or by integrating well-tested sustainability rating tools developed by organizations such as LEED or BREEAM-Community (Charoenkit & Kumar, 2014).

Many of the strategies developed for assessing sustainable affordable housing in the last decade have organized themselves following the same general structure proposed by Blair et al. (2004), with measurable indicators of success assembled into categories of social, economic and environmental factors. The indicators utilized in various assessment studies, as expected, vary according to the specific requirements of the cases under review, such as; location, governmental structure, business environment, geographic and ecological condition, social and cultural environment, and so forth.

## **The Mass Housing Development Administration (TOKI): Program and Goals**

The concept of housing as a human right is enshrined in the Universal Declaration of Human Rights (Assembly, U. G., 1948). This right is also included in Article 56 of The Republic of Turkey Constitution: "Everybody has the right to live in a healthy and balanced environment" and in Article 57 as "Our State shall take measures to meet the housing need within the framework of a plan to observe the characteristics and environmental condition of the cities" (TOKI, 2019).

According to Turkish Statistical Institute's Income and Living Conditions Survey conducted in 2018 the median annual household disposable income in Turkey was determined to be 24,199 Turkish liras (about \$4,576) in 2017 (Turkish Statistical Institute Press Release, 2019). The relative poverty rate for Turkey was also determined as 13.9%. The people having incomes below a specified line compared to the general population is defined to be the poor in a relative meaning. As of January 2019, the poverty threshold for a family of four was 6,543 Turkish Liras (\$1,232) as announced by the Confederation of Turkish Labor Union (Turk-Is). The poverty threshold depicts the amount of expenditures necessary for a family of four to purchase healthy food, while also including sufficient spending for clothing, housing (rent, electricity, water and fuel), transportation, education, health and related outlays (Hurriyet Daily News, 2019). Established in Turkey in 1984, the Mass Housing Development Administration (TOKI) aims to provide housing projects for people who do not have sufficient income to afford a house under the current market conditions (TOKI, 2013). In addition, TOKI is involved in the renovation of squatter areas; provision of new housing stocks in cooperation with municipalities; production of luxury housing for the purpose of creating blended social housing projects, production of land with infrastructure; provision of credit support to individuals, cooperatives, and municipalities; provision of mortgage loans to beneficiaries of projects; application of disaster housing, agriculture village projects and migrant dwellings; restoration of historically and/or culturally important buildings; as well as the organization and application of international projects and new partnerships with private investors (Devrim, 2016).

According to TOKI, 85% of the governmental mass housing investments were designed and built using accepted social housing concepts; but Turan (2012) states that only 25% of them actually provide social housing conditions. According to Devrim (2016), TOKI over the years has turned into a profit-oriented investor for high income customers in cities instead of ensuring social, physical and economic conditions for low income people as a non-profit public foundation. He further claims that TOKI's housing projects are designed and planned in ways that lack spatial cohesion, thereby producing weak or unsuitable socio-spatial relations with surrounding urban areas. According to Bican (2019) these projects use a set of ready-made architectural plans to design apartment blocks by replicating them in a vertical order depending on the volume of demand and the limitations coming from the site. The main concern is typically securing the maximum number of apartment units with the preferred spatial layouts. Furthermore, these residential areas lack local characteristics and they are designed in high density using

the same typology of housing style triggering the low profiled, uniform design across Turkish cities and neighborhoods (Devrim, 2012). In most projects, regional features such as urban form, topography, climate, cultural or regional differences are ignored, disregarding both environmental and cultural sustainability. Turkey, as a developing country, requires a substantial amount of housing stock. According to TOKI's vision, it is anticipated that approximately 7.5 million houses will be constructed from 2012-2023 in response to the expected population increase and urbanization in Turkey (TOKI, 2019). TOKI, as the leading public foundation, has a significant role in the affordable housing sector. However, in most of these affordable housing projects, sustainability has not been considered as a central issue of planning and architectural practice. While improving the quality and speed of building affordable housing projects, it is essential to also integrate sustainability and minimize the tension between housing demand and profitability (Bican, 2019). Sustainability is an inevitable expectation, when the environmental, social, cultural and economic benefits are concerned. A principal goal of this study is thus to help reintegrate sustainable goals and assessment strategies into future TOKI project development projects.

## **Methodology**

This study incorporates a review of existing literature on affordable sustainable housing in order to outline previous assessment frameworks in city planning and urban design literature. It then examines four housing projects, developed by the Mass Housing Development Administration (TOKI), in two prominent cities in Turkey, Bursa and Amasya. These project reviews include on-site contextual observations, literature review on the current status of affordable housing in Turkey, archival search of documents on the selected TOKI projects provided by the Republic of Turkey Prime Ministry and the Mass Housing Development Administration, and eight face-to-face open-ended interviews conducted with the TOKI management of each of the four case housing projects. This study is intended to be an initial step in helping to develop sustainability guidelines and assessment strategies for use in designing future housing developments as well as improving current projects. This investigation also serves as a baseline for future research on these and other TOKI projects.

## **Overview of TOKI Projects in Bursa and Amasya**

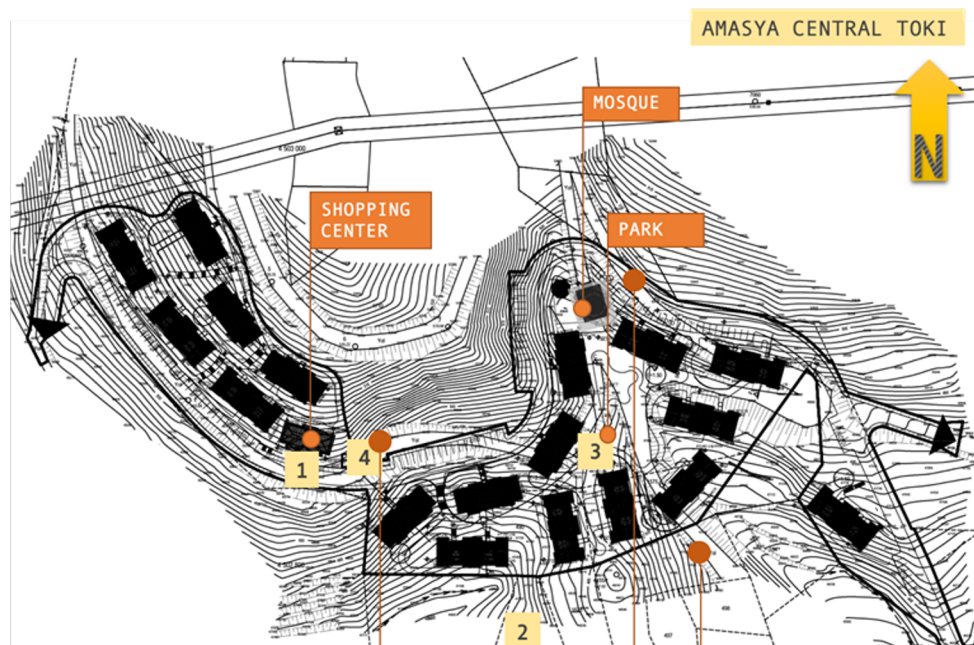
TOKI has developed numerous housing projects across Turkey over the years. This study examines two public housing projects located in Amasya and another two located in Bursa, which have been specifically selected as cases to appraise the strengths and challenges associated with sustainability in the context of affordable housing. Amasya Province, located in the Black Sea Region, next to the Yesilirmak River Valley, has a population of 329,888 (as of 2017) and is known for its ecological, historical, and cultural values. Amasya is in the group of cities which comprise the lowest 20% of Turkey in terms



**Figure 1:** Map view of selected housing project areas and downtown, Amasya (Map Source: Google Earth Pro, 2018; Photo source: July, 2019 by authors)

of population growth. However, it is in the highest 20% of Turkey in terms of population density because its location has limited land area in between the surrounding rugged mountains (Ocakci, 1998). The City of Amasya provides examples of traditional urbanism and architecture, particularly from the Ottoman period, even though the city

is challenged with modern developments that tend to ignore existing qualities of site, climate, urban scale, architectural character, history and cultural appropriateness.



**2b:** Amasya Central TOKI site plan (Source: Republic of Turkey Prime Ministry, Housing Development Administration-TOKI)

**Figure 2:** Site plans of two TOKI housing projects located in Amasya.



2a: Amasya Ziyaret TOKI site plan (Source: Google Earth Pro, 2018)

The two housing projects from the City of Amasya include Amasya Central TOKI and Ziyaret TOKI. The recent development of Amasya Central TOKI (see Figures 1, 2, 5 and 6) includes 18 seven-story buildings with a total of 284 dwelling units, with two housing units per floor. 178 of these units are considered as low-income housing. Located outside of the city center this social housing project is remote to the city center and other amenities available within the area. The land value in the area ranges from 10.00 Turkish Liras (\$1.79 USD) to 40.00 Turkish Liras (\$7.17 USD) per square meter. Similar to Amasya Central TOKI, another social housing project was recently completed on the opposite outer edge of the city within the boundaries of Ziyaret Township, named Ziyaret TOKI (see Figures 1, 2, 5 and 6). This development has a total of 12 six-story buildings with 288 dwelling units with a total of 176 of them considered to be dwellings for low-income residents. The land value in the area ranges from 20 Turkish Liras (\$3.59 USD) to 40 Turkish Liras (\$7.17 USD) per square meter.

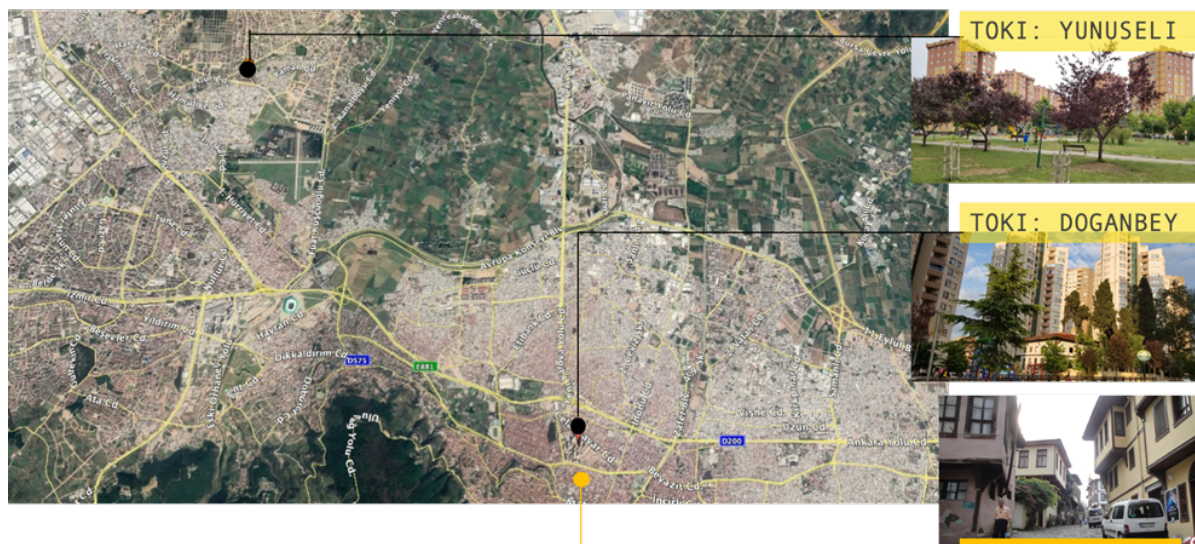
The City of Bursa, located in the northwestern Marmara Region of Turkey, is one of the most important cities in the country with its geographical, cultural and historical background as the first capital of the Ottoman Empire. Today it is the fourth most-developed city in Turkey with a population of 2,936,803 (as of 2017), which is expected to reach 3,231,286 by 2023. After the 1980s, due to the impact of a liberal economy in Turkey and the practice of spatial production due to the rapid population growth in the area, urban regeneration projects have occurred in various regions of the city, such as a well-known Doganbey area development (Eren & Tokmeci, 2012). This area is very close to the historical commercial center of the city. In 2006 a partnership between the Bursa Osmangazi Municipality and the Mass Housing Development Administration (TOKI) resulted in the Bursa Osmangazi Doganbey Urban Renovation Project, which enabled the building of 2500 luxury houses and 50,000 square meters of open space on the 282,000 square meter area of the Doganbey community. Different from the original intentions, however, the Doganbey TOKI housing

project, located in the Tayakadin neighborhood, resulted in 17, 23-story buildings including 3,200 dwelling units (see Figure 3). The residential land value in the area ranges from 75 Turkish Liras (\$13.44 USD) to 2,500 Turkish Liras (\$449 USD) per square meter. The Osmangazi Yunuseli TOKI project, located in the Hamitler neighborhood within the Osmangazi area of Bursa is farther outside of the city center, and includes 19 nine-story buildings with 912 dwelling units (see Figures 3, 4, 5 and 6). The land value in this area is estimated to range from 75 Turkish Liras (\$13.44 USD) to 163 Turkish Liras (\$29.22 USD) per square meter.

## Findings and Discussion

### Overview

Many factors are involved in helping to shape a more sustainable built environment. These factors can be defined and assessed based on interrelated measurable indicators that often fall into general categories such as economic/affordability, society, and nature/environmental. Current theory does not rely on any single factor to achieve a sustainable outcome, but on co-determinant and interconnected factors at many scales to create successful urban places. This common sense, comprehensive, and holistic approach should be utilized for developing goals and assessment strategies for affordable sustainable housing projects. Within this study of four TOKI housing projects, the following findings are presented within general categories of economic/affordability, society, and environmental/nature indicators, drawing out specific challenges or strengths within each category, and including details as to which of the four TOKI cases best illustrates that finding. In the conclusion section, the sustainability and affordability indicators are summarized (see Figure 6), and suggestions are made for improving assessment strategies in the future,



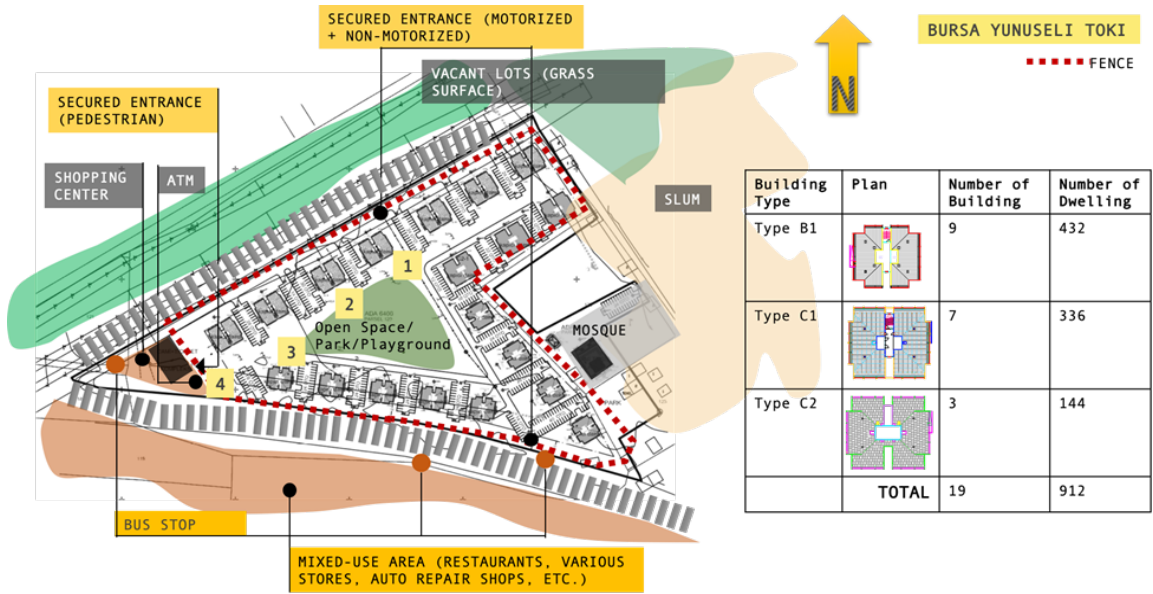
**Figure 3:** Map view of selected housing project areas and downtown, Bursa (Map Source: Google Earth Pro, 2018; Photo source: July, 2019 by authors)

such as including universal access, social acceptability, maintaining a holistic viewpoint, and so forth.

### Economic Indicators for Assessing Affordable Sustainable Housing

Özdemir Sarı and Aksoy Khurami (2018, p. 17) note that affordability in Turkish housing policy has been a significant concern since the early 2000s. Furthermore, the authors state that affordability is of particular concern in socio-economically developed parts of the country such as Bursa, since increased levels of economic development are usually coincident with housing shortages, at least for in the short-term. Part of the concern with examining and measuring affordability in Turkey has been in the “dynamics of the housing system at hand, which differs from the developed countries, particularly in ways of access to homeownership and the operation of the private rented sector” (2018, p. 18). Currently, Turkish housing policies support a home ownership approach based largely on the ability of a household to afford the purchase price or loan requirements, yet Özdemir Sarı and Aksoy Khurami (2018, p. 18) contend that for low-income households the long-term costs of maintenance, utilities, and other monthly expenses are considerable hurdles that are often not included in affordability assessment. They suggest a more holistic and qualitative approach to both developing, designing, and assessing affordable housing. Open-ended interviews with the Doganbey Management team revealed that one issue of immediate concern is an increasing annual maintenance cost factor for the TOKI housing projects. The annual maintenance cost for these housing developments is based on material, labor, required changes, and fluctuating or additional demands. Therefore, purchasing a home is almost certainly followed by additional spending after moving in, and presents another significant burden for low and middle-income households. For TOKI, focusing on long-term sustainability goals and measurable indicators may be better suited for low and middle-income households than short-term strategies that require higher lifetime maintenance and operating costs, such as power, elevators, streetlights, maintenance of open areas, and water/wastewater/stormwater. For instance,

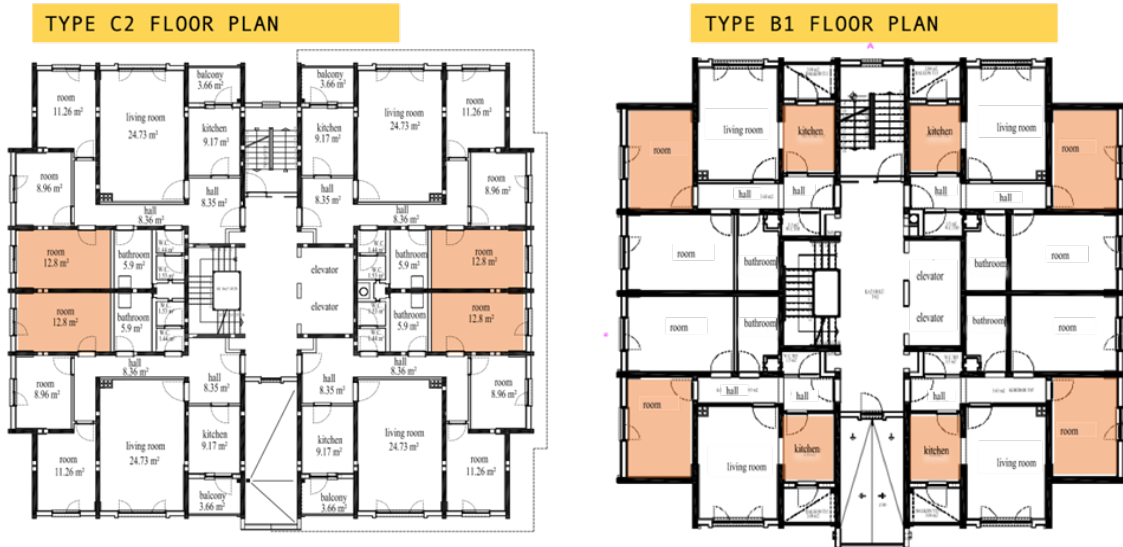
interviews with the management of Bursa Yunuseli TOKI revealed that in 2018 after heavy rains, the management team spent 8,000 Turkish Liras (\$1,398 USD) for maintenance and repairs in addition to 5,000 Turkish Liras (\$874 USD) that had already been used from January until the end of July 2019. When homeowners cannot afford ongoing operating or maintenance costs, a common result is postponing or totally disregarding the first stage repair or maintenance requirements (Özdemir Sarı & Aksoy Khurami, 2018, p. 18). This in turn can have a deleterious effect on the entire building. One significant factor to consider in assessing both economic and social issues in affordable sustainable housing in Turkey is the cost and availability of transportation for residents. Although a further discussion of access and transportation also occurs under social and environmental findings, there is a significant and immediate economic impact due to transport choices and availability. The Osmangazi Yunuseli has access to a frequent bus and dolmuş service through weekdays (every 10-12mins) and weekends (every 10-20 minutes) but has a limited number of bus stops around the neighborhood. Amasya Central, and Ziyaret TOKI case projects also have some access to local bus or dolmuş services, but there are concerns related to schedule, stop density and future availability of the taxi or dolmuş. The Doganbey TOKI site has both bus and light rail available in close proximity and it is at a relative proximity to downtown amenities. However, all four projects rely to some degree on personal automobile use as a primary form of transportation by providing parking spaces and easy street access. Both Amasya TOKI projects have reasonable time/distances (5-15 minutes) to downtown amenities by private vehicle, but that can be a difficult equivalent in walking distance; even assuming that there are continuous sidewalks along the necessary routes, or that the routes are walkable at all. The obvious concern with assuming that TOKI project households can, or will, use automobiles for necessary transportation is that private auto ownership in Turkey was still relatively low at 149/1000 in 2016, compared to other countries in Europe and Asia, such as 625/1000 in Italy or 615/1000 in Japan (Demiroğlu & Yüncüler, 2016). Even though car



4a: Bursa Osmangazi Yunuseli TOKI site plan (left) and types of buildings developed (right) (Source: Republic of Turkey Prime Ministry, Housing Development Administration-TOKI)

ownership has been increasing in Turkey in recent years, simply owning a car does not account for costs in fuel, maintenance, insurance, loan interest, and so forth - all of which are significant burdens on low and middle-class residents.

### Social Indicators for Assessing Affordable Sustainable Housing



4b: Bursa TOKI Yunuseli (Osmangazi) floor plans (Source: Republic of Turkey Prime Ministry, Housing Development Administration-TOKI)

Figure 4: Bursa Osmangazi TOKI Yunuseli Housing Project





**Figure 5:** Images of four TOKI housing project areas located in Amasya and Bursa (Photo source: July, 2019 by authors)

Successful urban design projects usually strive to provide accessible, flexible, and safe places for all users. Residential environments should be designed in consideration of each criterion of universal design in order to carefully and consistently provide safe and comfortable places for all demographics and physical abilities. Although livability, sustainability, social integration, planned urbanity, and development of design standards have been addressed in the national development plans as policies, these intentions were not fully transformed into practice in the building of residential environments. For example, Bican (2019) reveals that the principal of land choice in most TOKI projects falls short of maintaining the perception of social justice and equity, as it reserves valuable and centrally located land for high-income groups, while forcing those on a low-income to move out. Instead the low-income groups are provided with the option of living in the periphery with inevitable social exclusion caused by the classification of housing districts according to income levels and stacked into apartment blocks, as seen in the Bursa Osmangazi Yunuseli TOKI, Amasya Central, and Ziyaret TOKI housing projects. The use of standardized typological housing units, the focus on profitability, as well as the limited time considered for site planning by TOKI, lead to disregard for major context-dependent topographical, geographical, ergonomic, social, and cultural factors in many cases (Bican, 2019). This approach repeatedly resulted in major physical and functional shortcomings, notably, dull context-free residential settlements lacking in opportunities for local and innovative solutions.

Various levels of access to common urban amenities were observed for the TOKI projects in Bursa and Amasya (see Figure 6). For instance, Bursa Doganbey TOKI has easy access to numerous stores for essentials as well as leisure

activities because of its proximity to downtown. In addition, there are two modes of transportation, with both light rail and bus stops within walking distance of the TOKI housing development. Bursa Osmangazi Yunuseli TOKI, however, has a major issue that came to light during interviews with the management group. The housing project is quite distant from downtown and has limited minibuses near the site. This distance to downtown creates a burden for residents who must travel most weekdays for work or school. As noted previously, the use of private automobiles for required access is not necessarily an option for low to middle-income groups already struggling to cover normal monthly expenses. Amasya Central, and Ziyaret TOKI case projects also have some access to local bus or dolmuş services, but face limitations due to schedule, stop density and future availability.

Transportation, often a primary focus for urban-centered research, should be evaluated within various scales and dynamics. For example, determining appropriate distances from home to various locations for obligatory and /or leisure purposes, may not in and of itself help to reduce residents' monthly expenditures. Several questions need to be answered before suggesting locations for affordable housing projects. First, evaluating factors should include available modes of transportation, frequency, closeness to transportation nodes, available routes, cost of a ticket, and safety and security. If a location is not selected based on those criteria, low and middle-income families could end up with a significant financial burden. Likewise, long-distance travel with extended duration removes valuable time from the commuters' workday and often increases stress levels. Therefore, the chosen location may not be psychologically and financially reasonable for those who already struggle with time and budget. Osmangazi

Sustainability and Affordability Indicators		Case 1: Osmangazi Yunuseli TOKI, Bursa	Case 2: Doganbey TOKI, Bursa	Case 3: Amasya Central TOKI, Amasya	Case 4: Ziyaret TOKI, Amasya
<b>NATURE (Nearby or on Site)</b>	<i>Open space/parks/landscapes/bike paths Nearby</i>	3 nearby neighborhood parks within 0.5 miles range	9 nearby neighborhood parks within 0.5 miles range	6 nearby neighborhood parks within 0.5 miles range	No neighborhood parks within 0.5 miles range
	<i>Biodiversity</i>	Limited tree and plant types	Limited tree and plant types	Limited tree and plant types	Limited tree and plant types
	<i>Open Space Availability &amp; Condition on the Site</i>	Access to green space (Only for residents); no bike path available	No direct access to green space (One for residents only with pass required) ; no bike path available	Semi-public green space with limited access); no bike path available	Semi-public green space with limited access); no bike path available
	<i>Energy Conservation</i>	No Energy/Water/Waste Efficiency systems	No Energy/Water/Waste Efficiency systems	No Energy/Water/Waste Efficiency systems	No Energy/Water/Waste Efficiency systems
	<i>Solar Orientation</i>	Buildings not oriented based on the sun path	Buildings not oriented based on the sun path	Buildings not oriented based on the sun path	Buildings not oriented based on the sun path

**Figure 6a:** Comparative analysis of four TOKI housing areas using sustainability and affordability indicators: NATURE (Nearby or on Site).

Sustainability and Affordability Indicators		Case 1: Osmangazi Yunuseli TOKI, Bursa	Case 2: Doganbey TOKI, Bursa	Case 3: Amasya Central TOKI, Amasya	Case 4: Ziyaret TOKI, Amasya
<b>AFFORDABILITY</b>	<i>Housing Cost</i>	<u>Low-Income:</u> 47,956.46 TL for 84.04 m <sup>2</sup> (336 dwellings) <u>Middle-Income:</u> 109,850.43 TL for 125.12 m <sup>2</sup> (396 dwellings) <u>Institutional Group:</u> 109,850.43 TL for 100.91 m <sup>2</sup> (180 dwellings) (by TOKI)	Based on current real estate market (2019): around 300,000+ for 156 m <sup>2</sup> (3+1)	<u>Low-Income:</u> 46,636.49 TL for 82.32 m <sup>2</sup> (176 dwellings) <u>Middle-Income:</u> 81,496.03 TL for 132.89 m <sup>2</sup> (108 dwellings) (by TOKI)  Based on current real estate market (2019): around 145,000+ for 137m <sup>2</sup> (3+1)	Based on current real estate market (2019): around 130,000+ for 100-105 m <sup>2</sup> (2+1)
	<i>Land Value - Turkish Liras per meter<sup>2</sup></i>	75.00 to 163.00	75.00 to 2510.00	10.00 to 40.00	20.00 to 40.00

**Figure 6b:** Comparative analysis of four TOKI housing areas using sustainability and affordability indicators: AFFORDABILITY

Yunuseli TOKI and Amasya Ziyaret TOKI seem to be an example for that issue.

Pullen et al., (2010, p. 56) contend that one category for designing and assessing affordable sustainable housing should be social acceptability, meaning “the acceptability of a development by the surrounding community.” Although defining and measuring this category of indicators is somewhat complex, the overall acceptability level might be evaluated through a variety of indicators such as complaints filed with local governments or with the TOKI housing authority, or by the acceptance or

rejection of building permits from local authorities. Social acceptability could also be part of a post-occupancy effort by TOKI to enlist the opinions of both residents and neighborhoods adjacent to the property. Surveys or interviews conducted at several points of time after occupation of the development would aid in both the design and location choices for future projects. Social acceptability may also be affected by the design and layout of new housing developments compared to pre-existing buildings and streetscapes in the community. For example, constructing new 23-story residential buildings using a modern western style of design and materials on a large

Sustainability and Affordability Indicators		Case 1: Osmangazi Yunuseli TOKI, Bursa	Case 2: Doganbey TOKI, Bursa	Case 3: Amasya Central TOKI, Amasya	Case 4: Ziyaret TOKI, Amasya
<b>LAND USES (Nearby or on Site)</b>	<i>Commercial and Industrial On site/Nearby</i>	Plenty options - >15 groceries/retail etc. available within 0.5 miles range	Plenty options, >15 groceries/retail within 0.5 miles range	6 options or less, groceries/retail within 0.5 miles range	None within 0.5 miles range
	<i>Community Services &amp; Facilities On Site/Nearby</i>	- 1 middle school within 0.5 miles range  - Pharmacy/Post Office/Banks available within 0.5 miles range	- Only private (dershane) after school facilities available within 0.5 miles range  - Pharmacy/Post Office/Banks available within 0.5 miles range	- Three primary and middle schools within 0.5 miles range  - No Pharmacy/Post Office/Banks available within 0.5 miles range	- 1 middle school within 0.5 miles range  - 2 post offices within 0.5 miles range
	<i>Residential Type on Site</i>	Multi-story apartments complex - detached	Multi-story apartments complex - detached	Multi-story apartments complex - detached	Multi-story apartments complex - detached
	<i>Recreational/ Leisure (restaurants, coffee, bars, entertainment etc.)</i>	Varying options within 0.5 miles range	Plenty options, >15 within 0.5 miles range	6 options or less, groceries/retail within 0.5 miles range	None within 0.5 miles range
	<i>Mixed-Use On Site</i>	No (only residential)	No (only residential)	No (only residential)	No (only residential)
	<i>Building Density and Dwelling Units on Site</i>	19 buildings / 912 units 9-story height	17 buildings / 3,200 units, 23-story height	18 buildings / 284 units 7-story height	12 buildings / 288 units 6-story height

**Figure 6c:** Comparative analysis of four TOKI housing areas using sustainability and affordability indicators: LAND USES (Nearby or on Site)

undifferentiated and isolated property within an older neighborhood of five story buildings using traditional materials and historic streetscapes may not contribute to high levels of acceptance with neighbors. During the interview process, both the Bursa Osmangazi Yunuseli and Doganbey management groups were quite emphatic in describing the issue of loss of communication and contact between residents in their housing developments. The interviewees noted that loss of communication often creates low tolerance among residents and thereby results in constant complaints and arguments. Certainly, many factors can add to a loss of communication and contact between residents or groups of residents, but large dense building layouts with little ability to see or talk with the public at street level can contribute to this isolation. Part of the solution to this concern might include creating public spaces near or within the development where residents can engage and recognize each other, if only in an incidental way. The writings and research of Jane Jacobs (1961) and William Whyte (1980) have extolled the virtue of public spaces and streetscapes to engage and connect the public and have been used as a model for successful urban gathering places for the last half-century. One measure of social sustainability is the perception of safety and security (see Figure 6). Partially due to their size and location, both TOKI building complexes in Bursa

installed fences to create a secure environment. Access to those complexes are limited to their residents and requires a key fob for entry. Management groups from each TOKI development stated that before the fences were installed, there were many criminal incidents. In addition, the Osmangazi Yunuseli management group reported having to deal with the high cost of maintaining playgrounds, lights, and other outdoor elements due to the improper use of the building complex by non-residents. Further research should review the fenced areas over several time periods to understand whether these areas have any unintended consequences, such as further isolating residents or creating zones where no one feels comfortable gathering. This study also visually reviewed the grounds of the case study developments to highlight areas that were hidden from view from the standpoint of safety and security. Both Amasya TOKI developments and the Doganbey project in Bursa did have hidden areas within the grounds, some of which were protected by fencing. The Amasya Ziyaret Project used fences primarily to protect plant and gardening areas rather than as a security/privacy measure. In addition, the housing units have fixed layouts that do not allow for remodeling or adapting the interior spatial organization and thereby ignore the demography of the households. The units for low-income households typically are between 45 and 87 square meters in the form

Sustainability and Affordability Indicators		Case 1: Osmangazi Yunuseli TOKI, Bursa	Case 2: Doganbey TOKI, Bursa	Case 3: Amasya Central TOKI, Amasya	Case 4: Ziyaret TOKI, Amasya
NETWORK / TRANSPORTATION / INFRASTRUCTURE	<i>Vehicular Access (car, taxi)</i>	Yes (on site and adjacent streets)	Yes (on site and adjacent streets)	Yes (on site and adjacent streets)	Yes (on site and adjacent streets)
	<i>Public Transit (bus, minibus, light rail)</i>	Bus and minibus (dolmus) service, limited stops nearby	Light rail and bus stops within walking distance	Access to minibus - dolmus. limited Schedule and stop density	Access to minibus - dolmus. Limited Schedule and stop density
	<i>Walkability</i>	Score: 53 out of 100 (somewhat walkable - some errands can be accomplished on foot)	Score: 97 out of 100 (high walkability - daily errands do not require a car)	Score: 37 out of 100 (car dependent - most errands require car)	Score: 25 out of 100 (car dependent - most errands require car)
	<i>Universal Design/ Accessibility</i>	Inadequate - barriers with no clear alternate path (e.g. stairs, curbs or steep grades)	Inadequate - barriers with no clear alternate path (e.g. stairs, curbs or steep grades)	Inadequate - barriers with no clear alternate path (e.g. stairs, curbs or steep grades)	Inadequate - barriers with no clear alternate path (e.g. stairs, curbs or steep grades)
	<i>On-site parking</i>	Only for residents - pass is required	Only for residents - pass is required	Semi-public access	Semi-public access

**Figure 6d:** Comparative analysis of four TOKI housing areas using sustainability and affordability indicators: NETWORK / TRANSPORTATION / INFRASTRUCTURE

of apartments with either 2 or 3 rooms on average (TOKI, 2019). These units also fall short of providing flexibility in spatial organization and design that can support the needs of people with limited mobility and abilities. These projects lack proper universal design considerations both outdoors and indoors, such as ramps with proper slopes, walking routes with even surfaces, width of circulation areas and doors, window configurations, surface materials, and fixtures.

### Environmental Indicators for Assessing Affordable Sustainable Housing

Energy efficiency is one of the critical long-term factors that should be mandatory when developing or assessing the performance of any sustainable affordable housing project. However, the four TOKI housing projects reviewed here did not appear to integrate proper solar orientation or provide water/wastewater/stormwater management systems in order to optimize energy efficiency and water use. As stated previously, the buildings were not properly aligned according to the path of the sun for optimal passive solar efficiency. Designing four dwellings or more on each floor also makes it more length than the north-south axis, while the east-west axis should be within fifteen degrees of geographical east-west.

The reliance on private automobiles versus public transportation, or the minimizing of distances between TOKI housing projects and common amenities needed by project residents, should be of primary concern, both in assessing environmental factors for current developments, but also in early decision making for future TOKI project

design and location. As discussed earlier, transportation modes and availability have a very direct impact on the environment, including increasing carbon footprint, air and noise pollution, heat-island effect, and so forth. There are also significant additional ecological costs that are less visible, such as dedicating large areas of land in TOKI housing projects to impervious parking surfaces instead of green space, sports and recreation, or public gathering. Large areas of impervious surface also raise the potential for storm water management or flooding concerns. Simply taking care to locate future TOKI projects near resident amenities, such as retail, food, schools and mosques can significantly reduce transportation needs and thereby increase ecological sustainability. Where a central location or available public transportation are not options, it may be possible to integrate things like basic retail, schools, food and services directly into the lower floors of new or existing TOKI housing developments, allowing for a mutually beneficial mixed-use design.

### Conclusion

During the last quarter of the twentieth century, sustainable development and livable communities have been the focus of the planning and design fields with an overemphasis on ecological consequences of the relationship between human settlements and the environment. However, this focus created inevitable conflicts among its social, economic, and environmental principles due to the lack of an integrated approach in the

Sustainability and Affordability Indicators		Case 1: Osmangazi Yunuseli TOKI, Bursa	Case 2: Doganbey TOKI, Bursa	Case 3: Amasya Central TOKI, Amasya	Case 4: Ziyaret TOKI, Amasya
<b>SOCIETY</b>	<i>Safety</i>	Perimeter fence with limited access; Minimal hidden spaces on property	Perimeter fence with limited access; Hidden spaces do exist on property	Hidden spaces do exist on property	Some hidden spaces do exist on property
	<i>Privacy / Security</i>	Semi-private: Residents have pass to enter (protected by partial transparent fence)	Semi-private: Residents have pass to enter (protected by partial transparent fence)	Semi-public access	Semi-public access
	<i>Local Identity and Character</i>	No clear local characteristics - very similar to other TOKI projects in other cities	No clear local characteristics - very similar to other TOKI projects in other cities	No clear local characteristics - very similar to other TOKI projects in other cities	No clear local characteristics - very similar to other TOKI projects in other cities
	<i>Neighborhood</i>	Hamitler	Tayakadin	Seyhcu	Ziyaret Township

**Figure 6e:** Comparative analysis of four TOKI housing areas using sustainability and affordability indicators: SOCIETY

social and spatial transformation of cities and their neighborhoods.

In Turkey, TOKI is the leading public foundation in housing and has a significant role in the affordable housing sector in the country. However, in most cases, sustainability and universal design have not been considered as central issues in the planning and design of the TOKI housing projects. While trying to improve the quality and speed of building affordable housing, it is essential to also integrate sustainability and minimize the tension between housing demand and profitability (Bican, 2019). Sustainability is an inevitable expectation, when the environmental, social, cultural and economic benefits are concerned. This study aims to provide a framework that reintegrates sustainable goals and assessment strategies into future TOKI project development projects.

After carefully reviewing the literature and examining the four examples presented within this study, one fundamental asset appears to be crucial: achieving a balance between quality and quantity for affordable sustainable housing. Although there is high demand for affordable housing in the short term, after experiencing significant maintenance, repair, and replacement costs, there are increasing expenditures per dwelling every year, thus triggering more demand on sustainability. Developing and implementing sustainability goals for affordable housing projects can lower the expenses of maintenance, repair, and replacement, as well as diminishing the human-footprint. Advancing sustainability can also significantly increase residents' mental and physical health. As a major player in the housing sector, TOKI has the potential to improve the quality of the built environment by increasing standards and setting exemplary sustainability performances for the rest of the housing developers and construction sector in Turkey.

After reviewing the findings from the four TOKI projects, the following factors and associated indicators were of significant importance, and should be considered in addition to the typical assessment strategies employed in previous studies referenced here.

**Transportation:** Use a more comprehensive set of indicators to assess transportation costs in economic, social and environmental factors. For future TOKI projects, also try to balance the real cost in resident private automobile ownership and lack of public transit or walkability against land cost per square meter. That may mean, instead selecting sites that are less expensive in initial land cost, choose sites with more long-term value due to good access to public transport, or closer proximity to necessary amenities such as nutritious food outlets and health services.

**Universal design standards:** Future projects should maintain at least minimal standards of Universal Design as adopted by most developed countries and commonly required international building standards.

**Social acceptability:** Future TOKI housing projects should be developed with reference to adjoining neighborhoods, typical building styles, materials, spatial layouts, streetscapes and block patterns.

**Context-based design and planning:** Future TOKI projects should apply context-based local and innovative solutions that consider topographical, geographical, ergonomic, social and cultural factors. In this study, regional features such as urban form, topography, climate, cultural or regional differences were largely ignored, disregarding both environmental and cultural sustainability.

Energy efficiency: The future TOKI projects should integrate proper solar orientation and provide water/wastewater/stormwater management systems in order to optimize energy efficiency and water use.

A comprehensive and holistic view of affordability: Long-term sustainability goals and measurable indicators may actually be more affordable for TOKI households than short term strategies that require higher lifetime maintenance and operating costs such as energy.

In summary, it should be noted that this study is merely the beginning of a conversation, rather than a comprehensive evaluation of affordable sustainable housing projects. Future research and cooperative efforts with TOKI and its residents will be necessary to gauge the continued success of TOKI housing developments by using and refining the assessment framework presented here. The second stage of this research will benefit from randomized questionnaires with residents from all four cases as participants. Research-based practice and pre- and post- occupancy sustainability assessment of projects should become a common practice for public housing rather than an occasional methodology and activity based on sporadic preferences of agencies.

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## Keywords

Affordable housing, sustainability indicators, TOKI, Turkish cities