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Achieving sustainable transformation in dysfunctional urban territory

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ABSTRACT

Despite that cities are being built for people and by people, by 2024 there are no straightforward legit guidelines that would prescribe the steps of developing a sustainable neighborhood. Numerous neighborhoods, districts, and cities cannot provide safe and clean environments with healthy social interaction, fulfill the demand for health, child, and educational facilities, guarantee the right for adequate equal housing, and attract the public for economic prosperity and development. This study aims to propose a framework with which the practitioners can determine the necessity of the neighborhood for Sustainable Urban Transformation (SUT), hence influencing the development of sustainable neighborhoods, cities, and communities. In the study, Design Science Research Methodology (DSRM) was followed to create a framework. Preferred urban model tangible characteristics together with the main measurable indicators of the neighborhood have been combined into a framework. It has been categorized by social, economic, and environmental sectors and refers to Sustainable Development Goals (SDGs). The framework was reviewed by experts, which resulted in a gap in the research. Further application of the framework to the existing central neighborhood in Istanbul determined the necessity of sustainable urban transformation.

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INTRODUCTION

The idea of sustainability concerning a city pertains to the urban area and its surrounding region's capacity to maintain desired levels of quality of life for the community. This should be achieved without limiting the choices available to both current and future generations, while also avoiding negative effects within and beyond the urban boundary [1]. Literature sources provide numerous theories and concepts on what features a sustainable city, its districts, and neighborhoods should adopt. Also, studies related to the investigation of particular cases with a distinctive local range of urban problems are available.

Overall literature sources refer to the subject of SUT as a theoretical matter. The crucial point to end up with a solution is to refer to some values taken as norms that would indicate any deviations hence problematic fields. It is impossible to manage what is not measured. Yang Yan [1] emphasizes six key driving forces and nine indicators that are relevant to the sustainable urban transformation process. Six key driving forces: population, governance, policy, wealth (economic growth), technology and lifestyle. Nine indicators can be divided into three categories; (i) Indicators describing human well-being describe the socio-economic structure of cities (personal disposable income, life expectancy at birth, student-teacher ratio), (ii) Built environment establishes the backdrop for human endeavors, spanning from individual dwellings and neighborhoods to expansive civic landscapes, encompassing transportation systems,

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public areas, and various infrastructures. Construction, management, and use of these man-made environments and their connection to social activities (residential floor area per capita, public green area per capita, car ownership per 1000 persons), and (iii) Natural environments, such as air, water as well as energy, juxtaposed with the built environment, encompassing spaces, and elements significantly shaped by human influence (electricity consumption per capita, water consumption per capita, air pollutants).

Statistical data, being the objective part of SUT, helps to indicate trouble spots and the main vector of SUT. Remaining is the subjective tangible phase that represents the appearance of the concerned area. The Compact City Model and the concept of Human Scale in urban design possess the capability to fulfill this aim.

The concept of the Compact City depicts a system of mixed-use districts with a quality urban design where people live and work in the same place. Hence, shortened distances give people a choice regarding types of transportation systems to use and encourage developing the habit of sustainable modes. The compact configuration of districts improves social and communal relations and results in the growth and development of local businesses [2].

Following are the core dimensions of compact city urban form: adequate space for streets, efficient street network, high density, mixed land uses, social mix, limited land use specialization, Attractive, quality, and energy-efficient design of dwellings, sustainable transport, and accessibility [2].

"Human scale" in urbanism refers to the design and planning of urban spaces that are tailored to human dimensions. Such spaces foster a sense of community, promote pedestrian-friendly spaces, and enhance the overall quality of life. The Human Scale concept pursues objectives relative to the Compact City Model, mostly dedicated to measurable characteristics of the urban fabric and social interaction. Kuchenbuch [3] refers to the "pedestrian quarter-hour" to be the "most important unit of measurement in urban planning" as an indicator of the close spheres of social bonding within a community, that was found by Umlauf in 1941. In 1944, Gutschow arrived at similar conclusions. He proposed the maximum area for a settlement as the distance between a tram stop and an apartment that could be comfortably traversed on foot within "10 minutes, or 800-900 meters". Sert [4] stated that the organic structure of a modern city should promote community life and social interactions without hindering individual activities. Indeed, these activities should not impede the collective aspirations of the population as a whole. Nefedov [5] determined the condition of urban areas is an indicator of the ambiance of humanity. Klein [6] highlighted the necessity of the human scale for the human environment. He supported the possibility of excess size for the official buildings but insisted on human-scaled apartment buildings. Klein clarified this by emphasizing the significance of visually taking in the entire house dwelling, which offers psychological comfort for individuals.

Main indicators of the "human-scaled" environment; (i) Walkability (streets, sidewalks, and public spaces are designed based on two main scales according to Tobish [7]: 5km/h perspective and eye-level, (ii) Mixed-use development (a mix of residential, commercial, and recreational spaces within a neighborhood that supports local businesses, reduces the need for extensive travel and fosters a more interconnected and cohesive community), (iii) Urban density (human-scale urbanism doesn't necessarily mean low density, but it emphasizes an appropriate balance between vitality, urban energy and human comfort), (iv) Public spaces (parks, plazas, and squares design that encourages social interaction and community engagement, invites people to gather, relax, and strengthen the social fabric of the urban environment), (v) Architectural proportions (the scale of buildings and their relationship to the surrounding environment, visually appealing human-scale architecture in harmony with the surrounding context, avoided overly massive dominant structures for a more intimate and comfortable urban atmosphere), (vi) Street design (slower traffic and human-scale streets that provide pleasant and safe experience for people with the help of the street furniture, lighting, landscaping and features that encourage social interaction), (vii) Cultural and historical context (urban spaces that respect and incorporate local cultural and historical identity, preserved historic structures that are integrated into the urban fabric, hence contributing to a sense of continuity and connection with the past), (viii) Accessibility (pedestrians, cyclists, and individuals of all ages and abilities are equal while accessing urban public spaces and facing the infrastructure).

Together with statistical data, determined trouble spots of the neighborhood, and main indicators of the preferable urban concept, there should be legitimate support to implement the guidelines and frameworks for sustainable transformation nationwide. Developed by the General Assembly in September 2015, SDGs represent legitimate targets under social, economic, and environmental categories. Following SDGs correlate with the objectives of SUT: Goal 1 "No poverty", Goal 3 " Good health and well-being", Goal 10 "Reduced Inequality" indirectly highlight, and Goal 11 "Sustainable Cities and Communities" [8]. Targets indicated under the mentioned SDGs can influence on the procedure of passing the legislation for SUT frameworks and guidelines.

While conducting a literature review, it emerged that there is a lack of straightforward guidelines or frameworks that would contain a recognition procedure by determining the trouble points and the level of dysfunctionality based on the preferred urban model. The study aims to develop a framework approach to determine the necessity of the neighborhood for SUT hence influencing the development of sustainable neighborhoods. Therefore, this study intends to contribute to the initiation of a complex legit strategy for developing sustainable cities and communities that correspond to SDG 11.

METHODOLOGY

In this study, DSRM has been implemented to develop the SUT framework. The problem definition, obtained solution objectives for developing the framework, its demonstration by example, expert evaluation, that highlighted the research gap, and communication are provided in this section.

Problem Definition

A literature review is replete with separate valuable approaches, methods, and concepts relative to the development of sustainable cities. Taking into account the lack of a complex and straightforward framework for SUT in cities, the broad gap relates to the methods of determining the necessity of SUT for neighborhoods and districts. It encouraged us to engage in this study.

Offered by Yang Yan [1], such indicators as (i) Added value per capita and year, (ii) Tax revenue per capita and year and (iii) water consumption in households per capita per day represent the average numbers among all city parcels and can not reflect the current condition of the neighborhood. Statistic data regarding meeting the demand for childcare, educational, medical, and sports facilities can not be evaluated due to the lack of national or nationwide norms if such statistics are published. Therefore, alternative indicators should be developed to form a SUT framework for city parcels.

Solution Objectives

The following objectives of the framework are categorized into social, economic, and environmental sectors (Fig. 1): (i) Neighborhood's main measurable indicators represented with statistical data, (ii) tangible existing characteristics that appertain or diverge with the preferred urban model, (iii) SDGs and their targets. Stated measurable indicators reflect statistical data that peer to diminished performance according to the bottom threshold of normal. Tangible characteristics of the neighborhood reflect correspondence or discrepancy between the environmental condition and main features of the stemmed compact city model and human scale concept in urbanism. Objectives are supported with the reference to SDGs, which represent the legitimate base for developing and application of SUT with the help of targets, derived by the General Assembly. To evaluate the framework and its objectives, a survey has been conducted for urban experts. Based on this survey, together with overall expert satisfaction with the framework, additional indicators related to fulfillment in childcare and health facilities have been advised for the implementation. Due to the lack of national or global norms corresponding to the mentioned indicators, it formed a gap in the study.



Figure 1. SUT framework DSRM.

Design and Development: SUT Framework

Figure 2 represents the developed framework. Derived neighborhood indicators have been categorized into three main sectors for evaluation of the neighborhood condition. (i) Environmental indicators include air quality, noise, and illumination levels, which acquire critical significance in the case of housing exposition towards highways. Being one of the primary potential advantages of urban parcels, water expanse quality imposes conditions for overall environment appearance and public attraction. Urban patterns, heritage preservation, housing conditions, and waste management reflect applied sustainable principles in the matter of consistency. (ii) The social sector is formed with indicators, that usually display substantial differences between separate city neighborhoods. Level of overall safety within the determined area, modal split in transportation and infrastructure comfort degree, active recreation, and green areas fulfillment for the public. (iii) Economic indicators of the neighborhood reflect public attraction and prosperity, which mainly depend on existing dominants within the city parcel and their management.

Same time the framework shows the relation between indicators and SDGs, corresponding SUT. Adopted in 2015



Figure 2. SUT framework.

by the General Assembly, seventeen SDGs define targets to be achieved, addressing all aspects of human life. Designated SDGs that correlate with neighborhood indicators represent the example of a legitimate staging ground for the development and application of SUT. SDG 1 "No poverty" pursues the aim to ensure equal rights to economic resources for all, with a particular emphasis on vulnerable public categories; to achieve access to basic services, land ownership, control over property, inheritance, natural resources, and new sustainable technologies. SDG 3 "Good health and well-being" aims to put an end to the epidemics of water-borne and communicable diseases; cut the number of deaths and injuries resulting from road traffic accidents; substantially diminish the number of deaths and illnesses caused by hazardous chemicals, as well as air, water, and soil pollution and contamination; ensure access to high-quality essential health-care services. SDG 10 "Reduced inequality" is intended for the gradual attainment and sustainability of income growth of the population, empowering and supporting the social, economic, and political inclusion of all individuals, irrespective of age, gender, disability, race, ethnicity, origin, religion, or economic status; promoting relevant laws, policies, and measures to attain increased equality, especially through fiscal, wage, and social protection policies. SDG 11 "sustainable cities and

communities" pursues the aim of access to suitable, secure, and reasonably priced housing, along with essential services; upgrading substandard living conditions; access to secure, affordable, convenient, and sustainable transportation systems for everyone; focusing on improving road safety by expanding public transport with special attention to vulnerable populations; improvement of inclusive and sustainable urbanization; fostering participatory, integrated, and sustainable planning and management of human settlements; diminish the per capita environmental impact of cities, giving particular consideration to air quality and effective municipal waste management; universal access to safe, inclusive, public and green spaces, with a particular focus on vulnerable public categories; preservation and safeguarding the world's cultural and natural heritage [8].

To obtain results using the framework, the grading system has been set. Depending on obtained statistical data and the presence or absence of stated conditions, consents were assigned a value of "1", while denials were given a value of "0." In the context of the necessity of neighborhoods for sustainable urban transformation, a threshold has been set at 30% of the total possible sum or above, which corresponds to 6 points out of 19 and above.

Demonstration

The SUT framework has been applied to the determined area in Istanbul represented in Figure 3. A portion of it falls within the boundaries of the Fikirtepe neighborhood, with the majority situated in the Hasanpaşa neighborhood. To enhance convenience, the study exclusively employs the name "Hasanpaşa" to refer to the designated study area.

Hasanpaşa, situated near the crowded streets of Kadıköy and Moda, is a historically dense neighborhood. Despite its notable location, Hasanpaşa falls short of showcasing a vibrant social life that could attract residents and investors to contribute to its development. The neighborhood's abundant transport options, numerous social amenities, government institutions, educational facilities, and historical landmarks raise questions about why it remains neglected, sporadically deserted, and disorganized in the present day.

Updated SUT framework provided with the result of 11, corresponding to the necessity of the neighborhood for SUT with below-presented measures and characteristics.

Environmental: Air Quality Index (AQI)) range from 55 "Moderate" to 125 "Unhealthy for Sensitive Groups" [9]; noise level was measured by the sound level meter Unit-T Ut 353 Mini in June 2023. Obtained results determined noise levels higher than 78.5 dB, 82 dB, and 81 dB at night time, in the evenings, and during the day accordingly; Light Intrusion into windows by the front dwellings line exposed to the highway ~ 6 lux [10]; Shallow condition, visible garbage and slough at the water surface of the Kurbağalıdere creek (Fig. 4.); eventuated residence buildings and public areas without waste separation practice; existing examples of abandoned and partially destroyed heritage (Fig. 5); the existence of slums, exposed to the highway (Fig. 6);



Figure 3. Determined area of framework application.



Figure 4. Kurbağalıdere creek condition.



Figure 5. Left: Nurettin grocery store [14]; Right: Söğütlüçeşme Hamam [15].



Figure 6. Slums exposed to the highway and Metrobus lane.

Social: visual segregation between housing conditions (Fig. 7); green area per capita equals 1.2 m² [11]; absence of bicycle lanes; active recreation fulfillment results with 0.36 m^2 .

Economic: Salı Pazarı market and Kurbağalıdere creek, being the dominants of the neighborhood, were determined as inappropriately maintained to attract the public and yield a profit (Fig. 8); the average unemployment rate per 2022 equals 12,3% [12];

The latest statistical data related to safety has been published only for Istanbul with 3.9 crimes per 100000 inhabitants as of 2018 [13]. Also, this research was obtained in the absence of national or global norms for childcare and health facilities. These characteristics haven't been considered while obtaining the result.

EVALUATION

The framework has been evaluated by 5 experts, who graduated as urban planners or are currently involved in urban projects professionally. The survey consisted of a problem abstract, developed framework, and questionnaire, and conducted the evaluation. Participants are individuals with 9-14 years of experience currently working in Russia, Germany, and Turkey in private companies. Participants were invited to answer questions regarding the clarity and applicability of the framework to the neighborhoods in particular; the ability of the framework to determine the trouble points related to social, economic, and environmental sectors; the possibility of the framework to contribute to the development of sustainable cities and communities. It was offered to add alternative indicators that could help with developing of more accurate framework. Participants showed overall satisfaction with the framework and 40% of them advised adding indicators reflecting the childcare, educational, and health facilities. The absence of national or global standards aligned with the mentioned indicators elicited a research gap. To integrate into a framework a category related to the educational and health sector, there should be national or nationwide legit norms for the number of schools, kindergartens, hospitals, and sports facilities according to the amount of dwellings, population data, and public migration analysis. School and sports facilities fulfillment standards should also rely on the national development targets. The government should encourage public participation in education and aim for a healthier nation, consequently reducing the budget for health services.

DISCUSSION

The process of the SUT framework development uncovered the absence of important standards that would help in transforming the surrounding environment into sustainable. Difficulties in statistics research determined poor analysis and disclosure levels that step in the way of scientific studies, aiming to influence on development of sustainable cities and communities. Adopting the decentralized approach for sustainable city development, the SUT framework



Figure 7. Visual segregation between housing conditions.



Figure 8. Poor management of the neighborhood dominant, Salı Pazarı market.

should be developed in detachment from the average city statistics and characteristics. Drawing on Istanbul's example, city neighborhoods reflect different combinations of social, economic, and environmental characteristics, that support the idea of developing of SUT framework in particular. It may vary from neighborhoods with positive values in the economic sector, while social and environmental characteristics decline (e.g. Nişantaşı, Etiler), to environmentally and socially viable, but economically unfortunate (e.g. Kanlıca). Demonstration of the framework on the example of Hasanpaşa neighborhood stated declined characteristics in all sectors: social, economic, and environmental. It should encourage the development of national legit core guidelines and analysis systems that would monitor and elicit dysfunctional city parcels and assume measures duly.

CONCLUSION

A literature review related to the subject of urban sustainability and SUT uncovered the absence of a comprehensive and clear SUT framework in cities. The significant disparity concerning the approaches to assess the need and outline the process of SUT for neighborhoods and districts severally has been detected. The study pursues the aim of developing a SUT framework dedicated to neighborhoods.

The compact city model and the concept of the human scale in urbanism form tangible characteristics. Neighborhood statistical data represents the measurable indicators of the framework. Developed by the General Assembly and categorized by social, economic, and environmental sectors, SDGs represent the example of a legit staging ground for developing and application of SUT. The framework has been evaluated by the survey, conducted for urban experts. The evaluation resulted in overall expert satisfaction and educed additional measurable indicators related to childcare, educational, and health facilities. Due to the lack of existing national or nationwide norms, the mentioned indicators formed a gap in this research. The developed framework has been applied to the Hasanpaşa neighborhood and determined the necessity for sustainable urban transformation.

This study intends to contribute to further studies related to the analysis of small urban forms and possible alternative solutions for their sustainable transformation and development. The aim of the research is to initiate a complex legit strategy for developing sustainable neighborhoods based on open source data and direct attention of the government to the elaboration of educational and health sector standards. The objective point of the study corresponds to SDG 11 and lies in the transformation of the surrounding environment into a safe, inclusive, and prosperous, and increasing the quality of people's lives.

AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

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