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BAKU SEA-LEVEL RISE RESILIENCE CHALLENGES: BEYOND THE UNIDIRECTIONAL COASTAL URBAN RENEWAL PROGRAM

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ABSTRACT

Climate change is manifesting its influence on urban areas, intensifying apprehensions regarding their resilience in the face of future challenges. The challenges are notably pronounced in coastal city regions, marked by high population density and land use. Alongside the established perils inherent to coastal cities, such as irregular precipitation and cyclical water level fluctuations, the Caspian Sea region carries its own unique range of challenges associated with urban and industrial development, including activities like oil exploration and exploitation.
The challenges associated with the Caspian Sea's rising sea levels for coastal areas highlight the importance of integrating natural and physical protective measures into the built environment. Within this context, various urban planning strategies play a crucial role in adapting to and efficiently managing a range of challenges, notably including flooding, displacement, and infrastructure damage.
Baku, the largest city in terms of both size and population along the Caspian Sea, also grapples with the hazards linked to increasing water levels in its coastal urban areas. This is a significant concern for the city, as the increasing complexity of disasters disproportionately affects its coastal areas. Furthermore, the cyclic environmental risks in coastal urban areas are compounded by the growing influence of climate change, seismic hazards, and the potential for associated tsunamis.
The article begins with the analysis of current resilient situation of Baku related to sea level rise, addresses risks related to ongoing urban projects on coastal areas and emphasizes the importance of transcending a one-sided (unidirectional) urban renewal approach. It illustrates the various components of a comprehensive and holistic (multidirectional) framework tailored for urban littoral areas, aimed at bolstering the resilience of Baku's coastal areas.

Keywords: Sea Level Rise Adaptation, Flooding, Coastal Urban Areas, Baku and Caspian Sea.

1. INTRODUCTION

The effects of climate change are affecting urban areas, giving rise to growing concerns regarding the resilience of cities. The increasing complexity of disasters also exerts a significant influence on coastal urban areas, where they face a heightened vulnerability to the consequences of flooding, waves, extreme sea levels, runoff, land subsidence, and other hazards [28]. Coastal urban areas, which are notably known for their high population density, concentration of economic activities and extensive land use [13], will experience the most pronounced effects of rising sea levels and extreme weather events in the next decades [37]. Approximately 38% of the global population resides in coastal areas, which are defined as regions within 100 kilometers of the coastline [49]. In the past three decades, coastal populations have witnessed a worldwide increase, surging from 1.6 billion to over 2.5 billion [49].

Meanwhile, the UN's proposed New Urban Agenda [50] addresses the significant threat posed by climate change and increasing sea levels to coastal urban areas, reflecting a global acknowledgment of the severity of this issue. The Agenda underscores the necessity of measures by emphasizing the impact of climate change, especially rising sea levels that particularly affect

coastal areas, labeling them as vulnerable [50]. Alongside a significant population growth that surpassed 17 million by 2016, the Caspian Sea region exhibits distinctive vulnerabilities linked to urban and industrial development, encompassing activities like oil exploration [20]. These vulnerability factors coincide with the challenges faced by Caspian coastal cities, encompassing irregular precipitation and cyclical fluctuations in water levels, including both sea level rise and decrease.

The destructive impact of flooding and water level variability is also a notable concern for Baku, the largest city in the Caspian Sea region in terms of population size and the extent of urban and territorial transformation [3] [20] [1]. This is mainly because the increasing and compounding impact of multiple hazards and risks disproportionately affects its coastal regions, characterized by high population density and land use. Furthermore, the cyclical environmental risks in coastal urban areas are exacerbated by the growing impact of climate change, seismic hazards, and the potential for associated tsunamis [26] [30].

The mentioned challenges on the coastal urban areas can have adverse effects on the built environment as well as environmental and human security. An increase in water levels may lead to social and economic disruptions, environmental degradation, chemical pollution of waterfront areas associated with the oil industry, erosion, landslides, and more. Conversely, a decrease in water levels can result in issues like dust and sandstorms, storms, land salinization, and impacts on agriculture, ultimately affecting human security.

The various protective methods, encompassing both engineering and nature-based solutions, can actively contribute to reinforcing resilience, reducing and managing a spectrum of hazards and uncertainties in coastal areas. The efficient coastal management from flooding underscores the significance of establishing a comprehensive approach in urban development.

The article begins with the analysis of the current situation of Baku in terms of resilience related to a potential sea level rise, addresses challenges related to ongoing projects on coastal areas of Baku, and emphasizes the importance of transcending a one-sided (unidirectional) urban renewal program . The article finally illustrates the various components of a comprehensive and holistic conceptual framework tailored for urban littoral areas by referencing best practical cases from other cities. The aim is to strengthen the resilience of Baku's coastal urban areas.

2. METHODOLOGY

Methodologically, this article relies on a set of three complementary sources from Policy, Science, and Practical knowledge (fig. 1). Firstly, it involved consulting and collaborating with stakeholders from various public and private organizations enriching the article's knowledge with their insights (from 2018 to 2023). Following the presentations and illustrations of ongoing activities by organizations, the unstructured interactions (with no predetermined questions) with various organizations focused on the following elements:

- Understanding the specificity and nature of urban development and associated environmental hazards in coastal areas including in the context of the Caspian Sea;
- Understanding how various municipalities and local authorities consider the challenges posed by watershed and coastal flooding as well as sea level rise;
- Understanding the level of coordination of different organizations in developing strategies to address sea level rise and coastal flooding challenges.

Consulting and collaborating with stakeholders also facilitated obtaining reports and archival documents from the organizations mentioned in the references. Additionally, as part of showcasing best practices from other cities (see section 5), field visits and exchanges with stakeholders were also arranged in Switzerland (specifically, Geneva for the Aire River renaturation project) and in the USA (encompassing the West Coast, including Los Angeles and San Francisco, and the East Coast, with a focus on New York City).

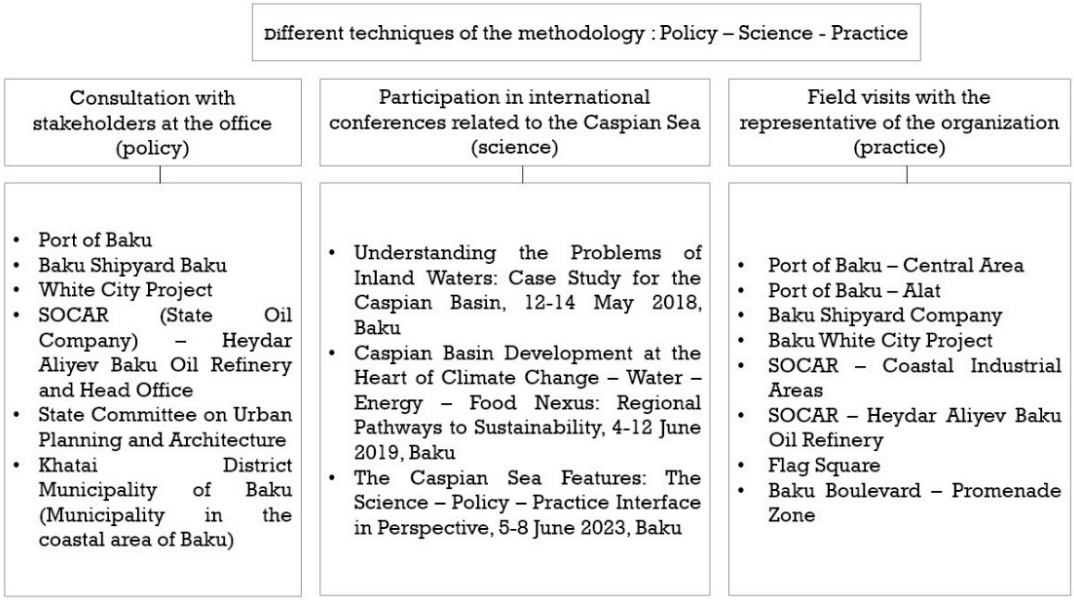


Figure 1. Employed methodology, Source: Tural Aliyev, 2023.

Secondly, interactions with interdisciplinary scientific experts during the roundtables/conferences related to the Caspian Sea influenced the analysis of the article, incorporating complementary sources of expertise and knowledge. This additional expertise was gathered through interactions with scientific experts actively engaged in Caspian Sea research. This also occurred during expert meetings and working groups aimed to establish an interdisciplinary platform focused on addressing Sustainable Development Goals. Lastly, field visits to different coastal areas of the city of Baku with the representatives of organizations were indispensable for acquiring firsthand knowledge from on-site experiences (fig. 2).

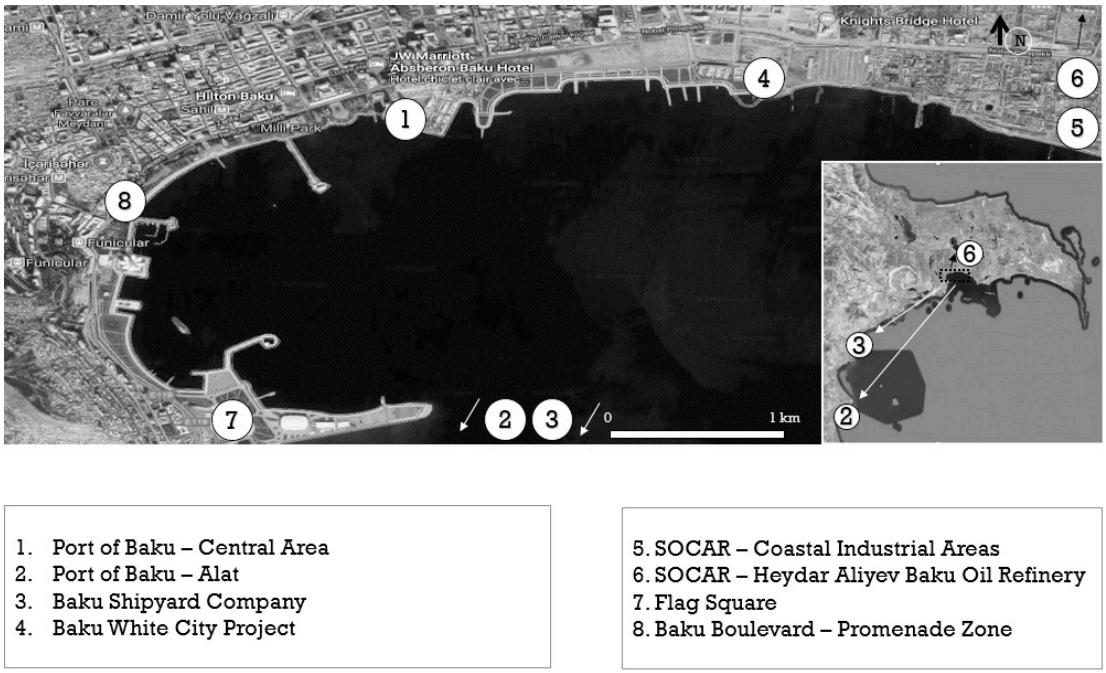


Figure 2. Field visits to coastal areas of Baku (left) and Greater Baku (right). Source: Google Earth, Tural Aliyev, 2023.

These three crucial elements were integral in gathering the complementary data and sources, comprehending the local context, and understanding the unique nature of urban development in Baku's coastal areas.

3. FLUCTUATION OF THE CASPIAN SEA AND COASTAL URBAN AND INDUSTRIAL EXPANSION

The Caspian Sea, a major natural feature, is by far the largest landlocked saltwater body in the world with an area of over 371.000 km2 [35]. The Caspian Sea plays a crucial role for riparian states such as Azerbaijan, Iran, Kazakhstan, the Russian Federation, and Turkmenistan, but it also presents challenges to the littoral areas of these states [20] [1].

In addition to the risks associated to coastal cities (irregularities of precipitation, cyclic changing of water level), the Caspian Sea has its particular risks related to the patterns of coastal urban development and industrial development. Ongoing activities in the Caspian Sea region include oil and gas exploration and exploitation, ship and diesel locomotive construction, as well as agricultural and fishing endeavors [20] [4] [5].

The Caspian Sea's water level, currently at -28 in altitude [32] has the potential to rise to a maximum of -25/-26 under specific conditions, such as continuously humid years. For instance, it was absolutely unexpected for the scientific community that the Caspian Sea level continued to decrease from the 1940s to the late 1970s, followed by a rapid 2.5 increase over two decades after 1977 [14] (fig. 3). The increase of sea level has caused flooding with the destruction or damage of buildings, engineering structures, roads, beaches, and farmlands in the coastal zone [42].

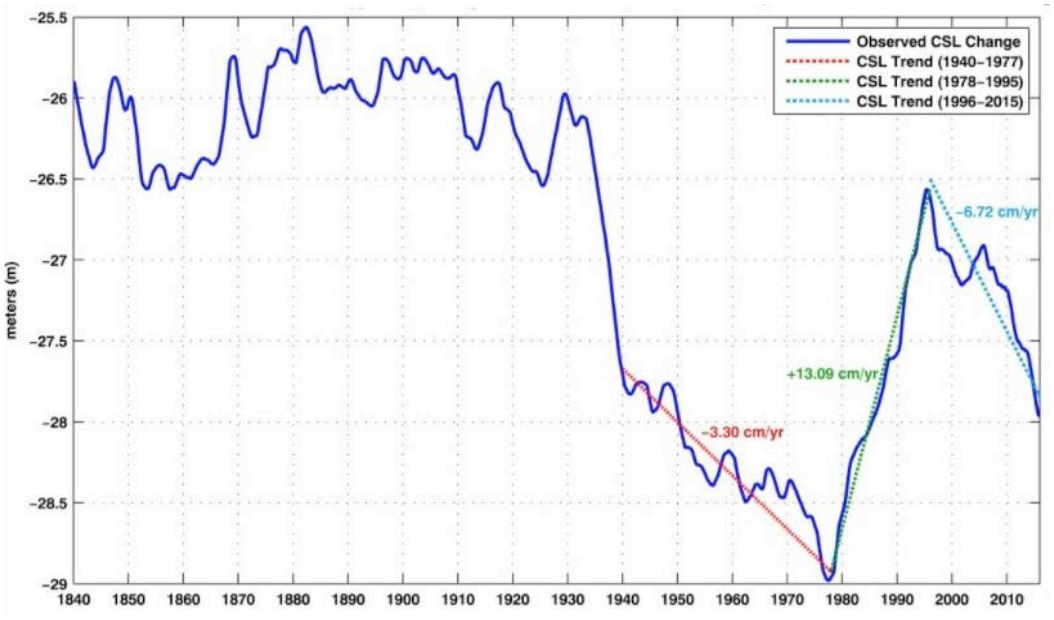


Figure 3. Fluctuations in the water level of the Caspian Sea from 1840 to the present day, Source: Chen et al., 2013.

The Caspian Sea level can fluctuate by up to 2.5 meters or decrease by 1.5 meters as part of its natural variation cycle [18]. These ongoing fluctuations are a result of changes in the water balance elements influenced by climate variations and the utilization of water resources in the sea's catchment area [34]. The water balance of the Caspian depends directly on climate change occurring throughout the Caspian Sea basin watershed to which the Volga river provides more than 80% of the water volume [2]. Furthermore, the cyclical environmental risks in coastal urban areas are exacerbated by the growing impact of climate change, seismic hazards, and the potential for associated tsunamis [26] [30].

Within this context, the 17 million inhabitants (data from 2016) living on the coastline of the Caspian Sea region find themselves facing the risk of flooding [20] (fig. 4). In terms of demographic growth and urban development patterns, Azerbaijan, Iran, and Russia exhibit higher populations in the Caspian coastal zones.

Figure 4. Population by number in the Caspian Sea region par cities and administrative units. Source: Indicated in the map, 2018.

In Iran, the three regions of Gilan, Mazandaran, and Golestan, which border the Caspian Sea, are also densely populated. In Russia, cities such as Astrakhan, Derbend, and Makhachkala, in addition to Turkmenistan's Turkmenbashi and Kazakhstan's Aktau, have developed around waterfronts [20].

In Azerbaijan, for instance, 66% of the population resides within 100 km of the Caspian Sea, and 36% of the country's population inhabits only 6% of its territory, mainly in Baku region [20]. Moreover, it has been disclosed that more than half of the coastal territory of the Republic of Azerbaijan experienced flooding during the rise of the Caspian Sea level by 2.5 meters in the period from 1978 to 1996 [2]. Within this context of flooding, the housing and economic structures situated along the entire expanse of the coastal zone under the threat of flooding have been identified including 50 settlements, 250 industrial enterprises and 60 km of highways [2]. The total area of the potential flooded areas in Azerbaijani coastal areas are 484. 5 square kilometers [2].

4. NOTION OF RESILIENCE IN THE CONTEXT OF FLOODING

In general terms, the concept of resilience is frequently characterized as an "umbrella concept" [25] that serves to operationalize uncertainty in complex scenarios [15]. The term resilience is a relatively recent concept in the context of climate change and has a common

definition, which is: "[...] the ability to recover and adapt, to maintain sustainability within an organization or society, and to ensure a degree of continuity in a dynamic environment" [41].

Moench [31] and Proag [39] have delineated two overarching forms of the resilience concept. The first aspect is termed Hard resilience that pertains to the inherent strength of structures or institutions when subjected to pressure. In the context of disasters, resilience is often regarded as the direct opposite of fragility. For instance, engineers frequently focus on enhancing the resilience of a structure through specific reinforcement measures to decrease the likelihood of collapse when subjected to various stressors. As resilience increases, the extent of damage from a given level of hazard diminishes [31] [39]. The second facet is referred to as Soft resilience, meaning the capacity of systems to absorb and rebound from the effects of disruptive events without necessitating fundamental alterations in their function or structure.

These aspects can minimize damage related to flooding in coastal areas and losses by integrating buildings, infrastructure networks, and their functions. This may necessitate citywide adaptation efforts to mitigate adverse consequences. The potential benefits are twofold: reducing direct and indirect costs while minimizing operational disruptions and business interruptions. Additionally, urban planning, forms, network establishment, and infrastructure and service localization choices (with consideration for avoiding high-risk areas) may require innovation.

In simpler terms, within the realm of urban planning, a resilient city can be understood as a city with the ability to adapt to unexpected events, particularly in minimizing the impact of natural disasters. The ultimate goal is to swiftly restore normalcy in the face of such adversities. Essentially, a resilient city is one that possesses the capacity to navigate through unforeseen challenges, implementing effective measures to mitigate risks and ensuring a prompt return to a state of stability.

5. FROM INTERTWINED CHALLENGES TO INTEGRATED SOLUTIONS: COASTAL URBAN AREAS AS LIVING LABS

Climate change impacts are increasingly bringing the interconnected challenges faced by coastal cities to the forefront. Coastal urban areas, more than ever, are grappling with a multitude of challenges, serving as experimental grounds for new policies and strategies that address problems while emphasizing the urgency of integrated solutions. These solutions consider the green (biomass and vegetation), blue (water), and grey (built infrastructure) assets of urban areas. In this context, innovative policies like National Urban Policies are emerging to meet the governance demands posed by climate change [51] [23].

Recognizing that there is no one-size-fits-all approach to adaptation, the implementation of such strategies is heavily influenced by local conditions, impacting feasibility and outcomes [6]. Well-documented approaches to fostering enabling conditions for adaptation include integrated planning, collaboration among multiple agencies, and actions that span multiple scales and sectors [21].

In addition to conditions for adaptation, there are also potential solutions that could enable densely populated coastal urban areas to formulate resilience-based strategies, adapt to sea level rise and coastal flooding. The examples include several methods, drawing from practical examples and established best practices found in the context of other cities. On one hand, the responses aim to combat rising sea levels and coastal flooding or adapt to new climatic conditions, while on the other hand, they strive to establish the integrated management of these strategies [27]. Mainly, the possible responses for the city of Baku could potentially be classified into three main directions:

a. From Risk and Vulnerability Identification to Nature-based solutions : the case of Geneva

In contrast to "hard" engineering structures, coastal vegetated ecosystems and biogenic reefs possess the ability to self-adapt to rising sea levels through various mechanisms. Vegetated ecosystems can boost soil vertical accretion and elevation by accumulating substantial

belowground biomass and trapping particles from the water column [17] [22] [38]. In the context of the growing demand for cost-effective, sustainable, and resilient solutions, nature-based solutions are emerged as alternatives to address hazards while simultaneously promoting biodiversity [19]. Nature-based solutions encompass activities aimed at safeguarding, sustainably managing, and restoring natural or modified ecosystems that offer crucial ecosystem services for both human well-being and biodiversity [16].

The Canton of Geneva initiated its exploration of nature-based solutions by addressing the identified and mapped flood risks (fig. 5). Once these risks were identified, they were integrated into the urban planning and territorial development.

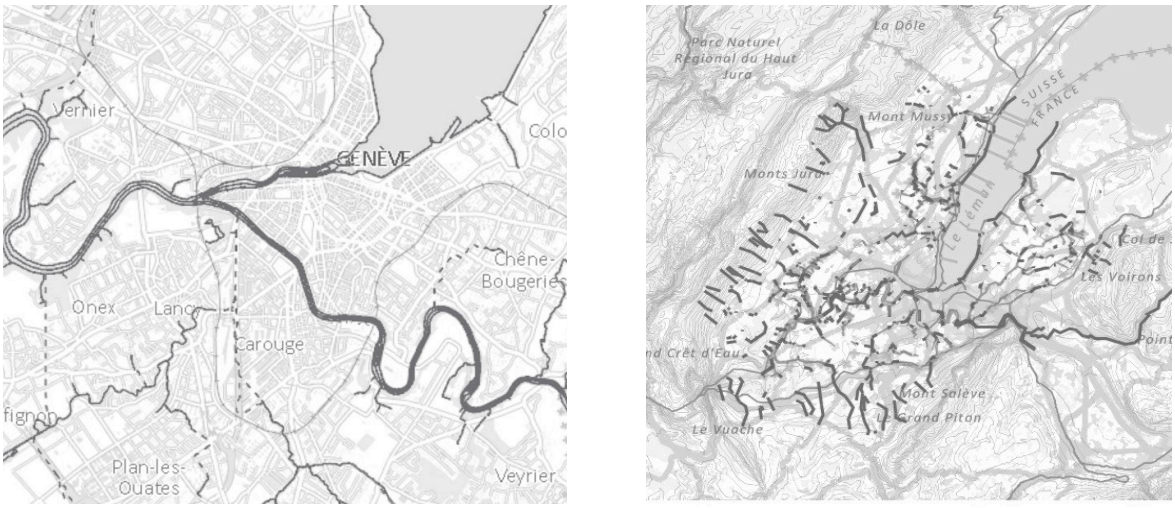
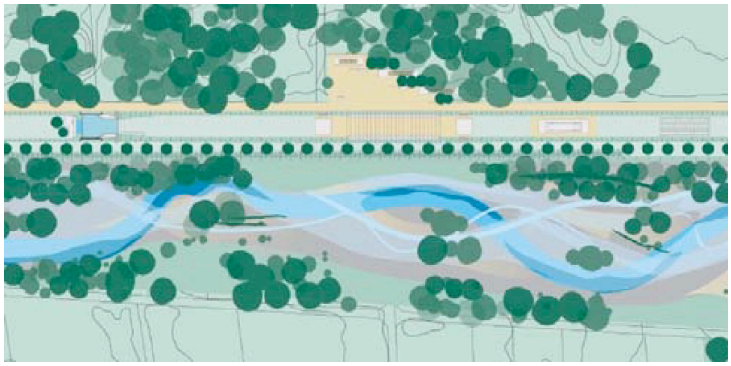


Figure 5. Watercourse of the Canton of Geneva (left) / Stretches of watercourses - open sky, buried watercourse, pipeline, under body of water (right), Source: SITG.

Even though the project in Geneva (Switzerland) is not situated on the seacoast, it serves as an example of nature-based solutions connecting the green, blue and grey assets. From identifying vulnerabilities and new sets of risks, the State of Geneva has aimed to enhance resilience and protect against flooding through watershed and infrastructure development. This project aims to position itself as an exemplary model for managing inherent risks in decision-making by thoroughly assessing, analyzing, and mitigating risks to increase the likelihood of successful decision outcomes.

- The Canton of Geneva's approach to addressing flooding risks through nature-based solutions.



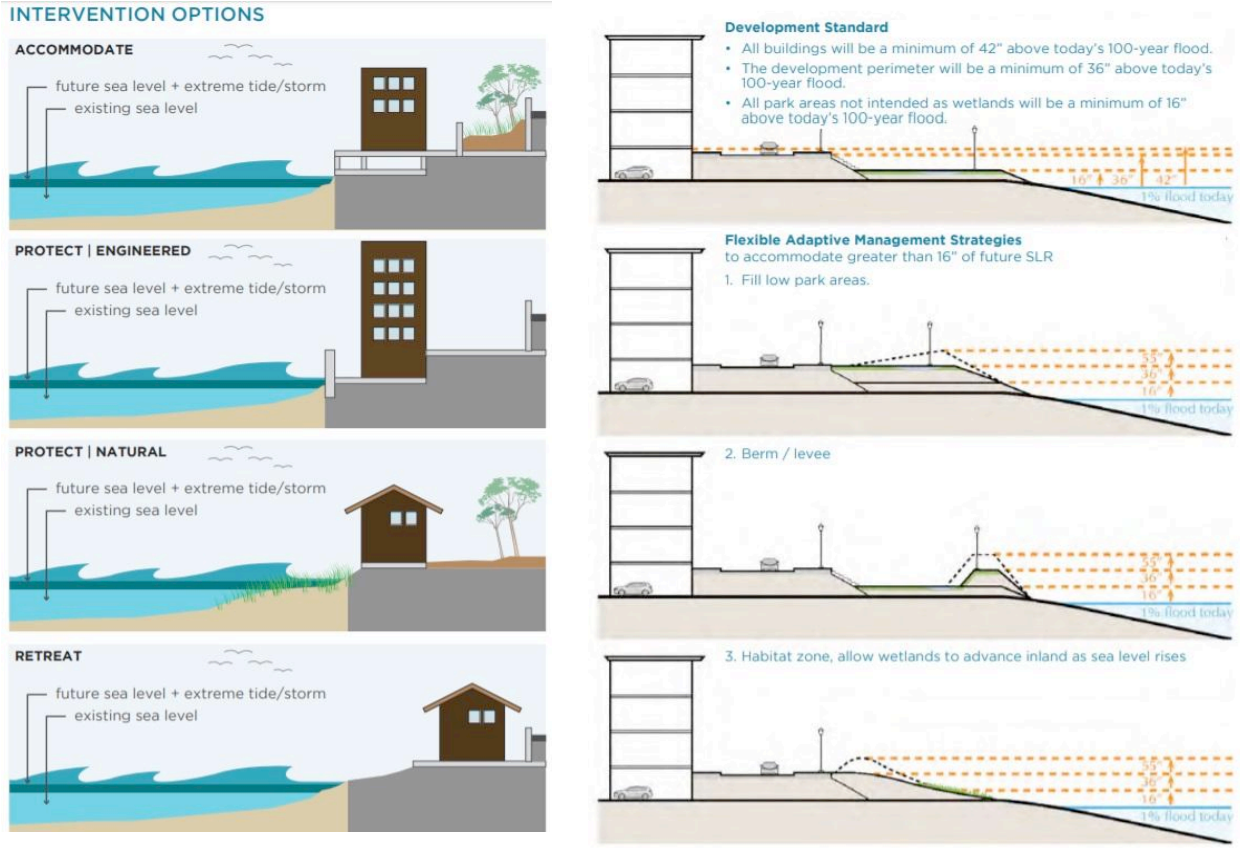

This initiative aimed at spatial inversion, viewing green spaces as a connecting matrix between safeguarding natural heritage and urban modernity. Focused on renaturing the Aire area, the project prioritized nature as a social endeavor. The revitalization program responded to flood risks and environmental challenges, employing a multidisciplinary approach with architects, hydraulic engineers, civil engineers, and biologists forming an innovative collaboration. The project's approach allowed the river to choose its course, inducing controlled "chaos" through floods. Executed in multiple stages, the initiative utilized historical maps for a uniform structure. According to the Canton of Geneva [8], the project has demonstrated successful outcomes, restoring morphology and biodiversity, and witnessing the return of lost species.

Figure 6. Aire river revitalization project. Source: Canton of Geneva 2023, Fabio Chironi 2016.

b. Engineering-based solutions : the case of San Francisco

Throughout history, resilience was traditionally seen as a protection achieved by using engineering solutions as the main way to avoid risks [24]. This also required the maintenance costs of the structures, which could become unfeasible [33]. The main aim of engineering solutions was to involve intentional human intervention in altering the direction, attributes, or dynamics of water resources to manage them effectively, mitigate the threat of flooding, and facilitate smoother navigation across rivers.

- San Francisco's (USA) approach to addressing sea level rise through its Sea Level Rise Vulnerability Plan [44] serves as a noteworthy example of engineering solutions.

An integral measure within this initiative is the Embarcadero Seawall, a century-old foundation supporting over three miles of San Francisco's waterfront. Beyond current flood protection, the Seawall aims to provide a stable foundation for future sea level rise adaptation, along with reducing significant seismic risks.

Figure 7. Main elements of the Sea Level Rise Action Plan. Source: San Francisco Planning, 2016.

c. Innovation-based solutions : the case of New York City

Instead of constructing traditional infrastructure, adaptive responses for accommodation encompass a range of technological, architectural, and urban planning measures. Linham and Nicholls [29] encompass technologies and innovations that involve physical modifications to exposed buildings or infrastructure, such as elevating structures, providing individual protection, adjusting urban drainage systems, and experimenting with concepts like floating housing [48] and investigating the principles of "New Urbanism" [46].

- The New York (USA) Plan on Disaster Risk Reduction [36] focuses on enhancing the city's resilience against flooding.

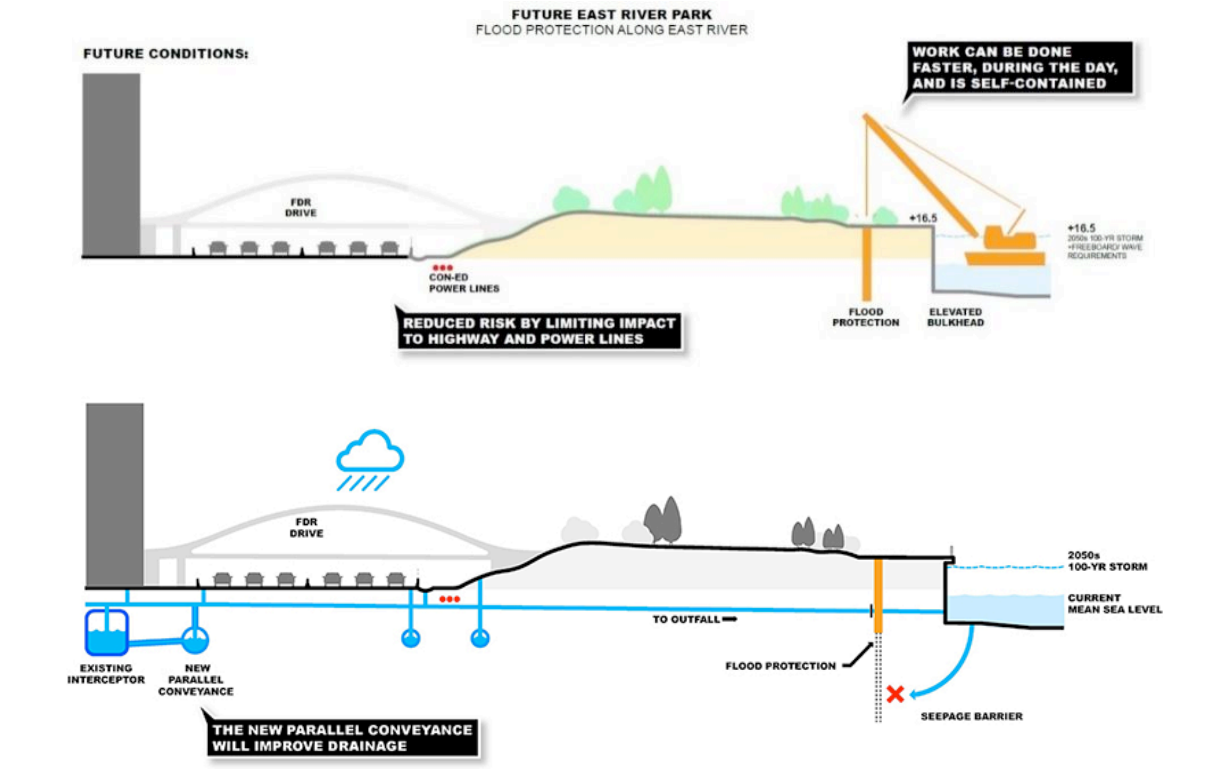


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Figure 7. Main elements of the Sea Level Rise Action Plan. Source: San Francisco Planning, 2016.

The illustrated different solutions drawing from practical examples are the measures for enhancing resilience against flooding and sea level rise. These solutions encompass the concepts of Hard and Soft resilience. The first one is primarily aimed at bolstering an area's resilience through targeted reinforcement measures to reduce the risk of collapse under different stressors. On the other hand, the second one aims to enhance the ability of systems to absorb and recover from the impacts of disruptive events without requiring fundamental changes to their function or structure.

6. FLOODING CHALLENGES IN THE CONTEXT OF BAKU'S COASTAL RENEWAL STRATEGIES

In Baku, the largest city in terms of population on the Caspian Sea, 26% of the country's population — officially 2.5 million inhabitants — resides on just 3.2% of the territory in the Greater Baku region [8]. This region includes the cities of Baku, Sumgait, Xirdalan, and the urban installation of the new port of Alat in the south. In addition to dynamic demographics, the distribution of the population is also important because the concentration of a significant population in the Baku region undermines the resilience of coastal areas.

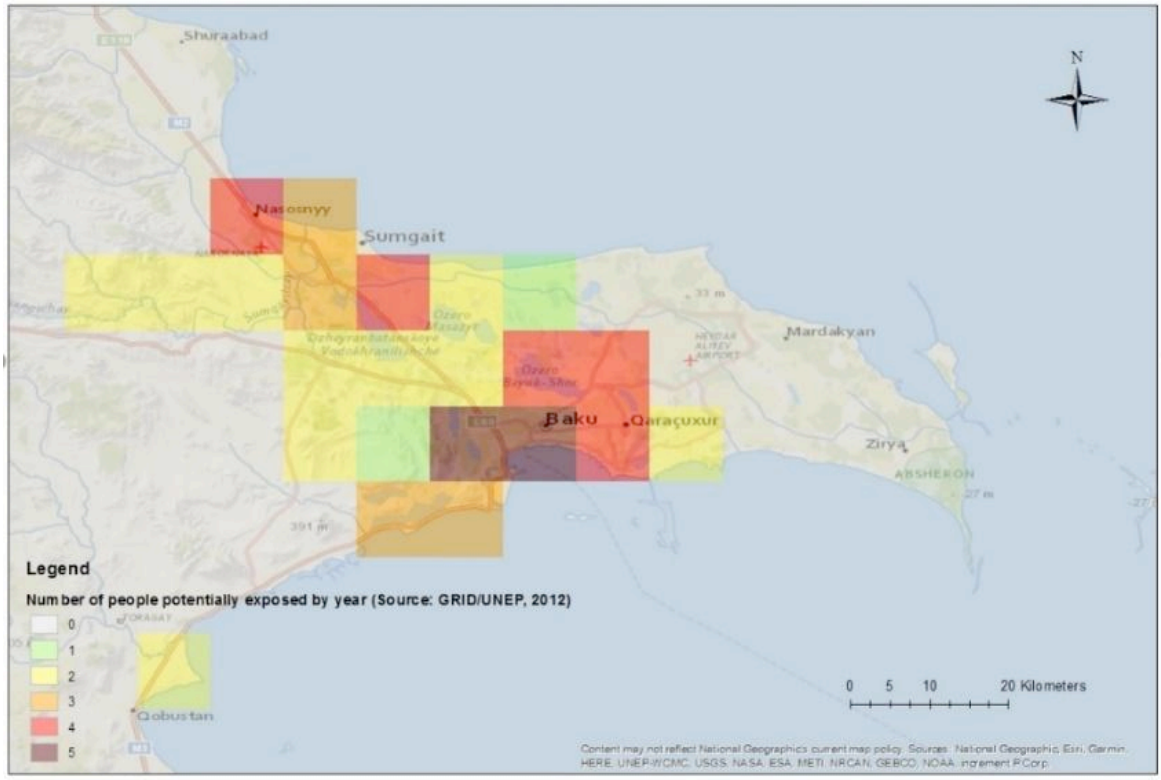
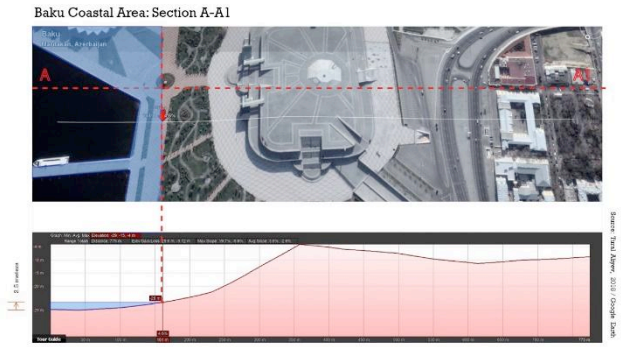


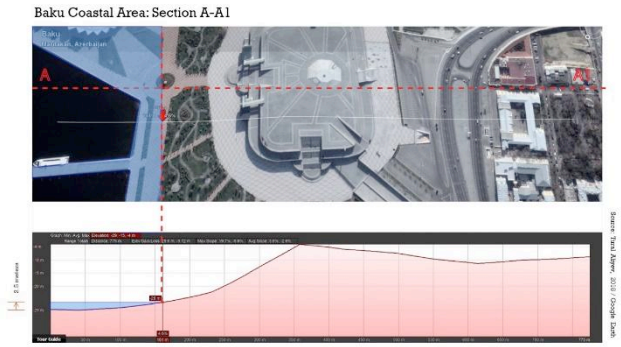
Figure 9. Number of people potentially exposed by flooding in average per year in Baku region. Source: GRID-UNEP, 2012.

Furthermore, the Greater Baku region is the center of the oil industry, the main source of the national economy, and a site of intense migration. This region provides 98.3% (17,002 million manats in 2011) of the total state budget revenues [8]. Considering that Baku focuses primarily on the economic development of its coastal areas, the risk related to water assessment becomes increasingly significant. These fluctuations can have negative repercussions on the built environment and human security on the coastal areas, which positioned at the fourth and fifth levels of flooding risk (fig. 9). If we conduct the simulation as explained in figure 10, we can identify the areas that could potentially be inundated:

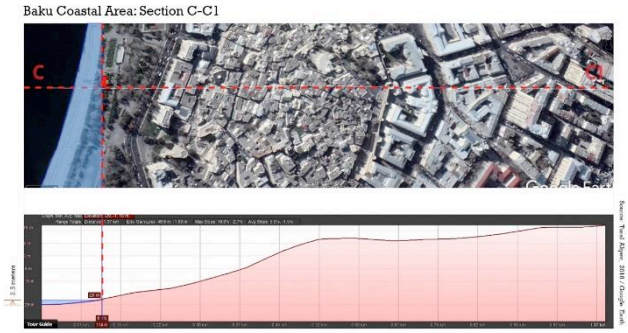
Certainly, the vulnerability and flooding simulation shown in this figure will not be linear. However, to better comprehend its significance, we have decided to utilize Google Earth to illustrate which areas will be conditionally flooded.



Baku Crystal Hall, an indoor arena inaugurated during the Eurovision Song Contest in 2012, is a critical city infrastructure that will be flooded in the event of a 2.5-meter sea level rise scenario.



The recently constructed Waterfront Caspian, an entertainment and leisure center, will also face flooding in the event of a 2.5-meter rise in sea level.

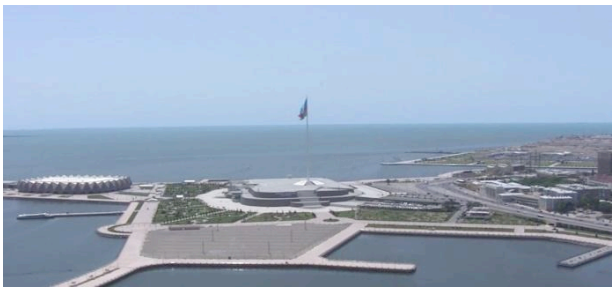


The primary promenade zone in the city of Baku, known as Baku's Boulevard, encompassing both the historical old city and contemporary structures, is susceptible to flooding in a scenario involving a 2.5-meter rise in sea level. This buffer zone between the natural environment (the sea) and the built environment acts as a protective measure against environmental risks.

Figure 10. Selected critical infrastructures of the Baku's Coastal Area. Source: Tural Aliyev, City Administration, Google Earth, 2023.

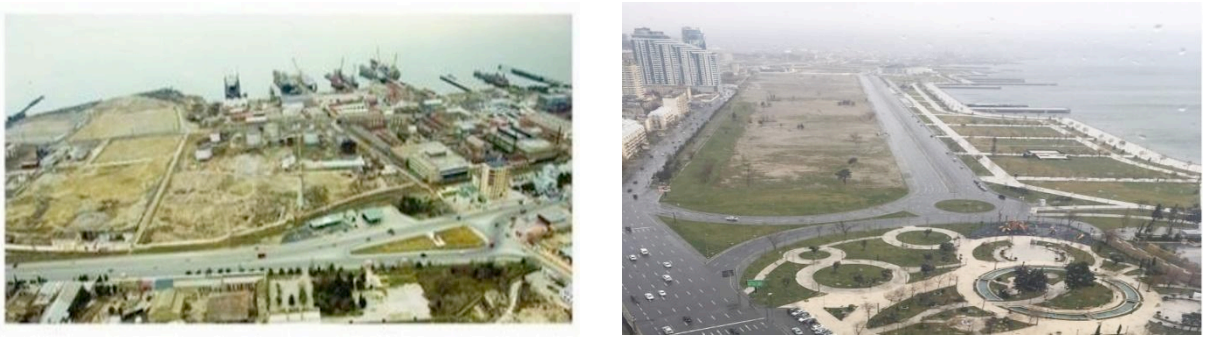
Within the mentioned challenges in coastal urban areas, it is crucial to analyze the specificity of ongoing coastal renewal projects to comprehend how the city addresses potential flooding scenarios. Three selected examples depicted in figure 11 offer a closer examination of the characteristics of urban renewal in coastal areas:

Before 2010 After 2010

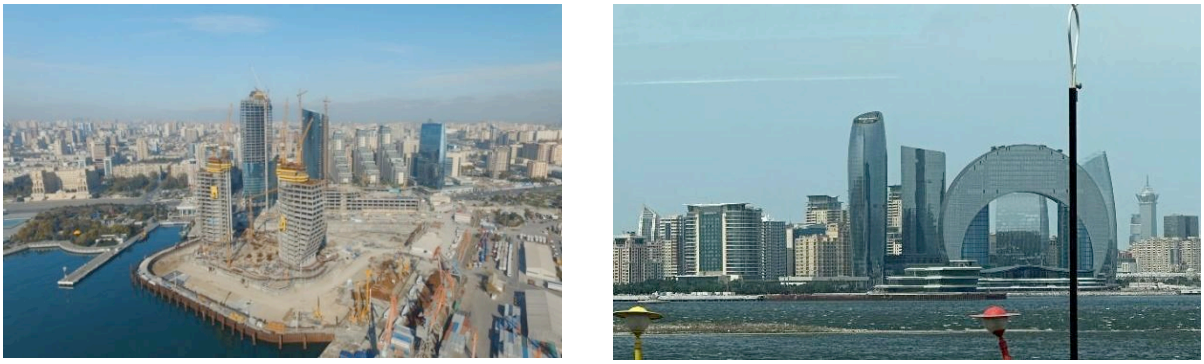


The Flag Square covers an area of 100 hectares (1 km²), and when combined with Water Place Square, the total

area is approximately 151 hectares (1.51 km²). The real estate market, both before and after renewal, reflects significant changes. In 2009, prices were at 1250 AZN per square meter. However, with the introduction of project such as Sabah Residences in 2019, prices have risen to the range of 1900-2800 AZN per square meter (equivalent to 1120-1650 US dollars) [43]. Field visits (see section 2) clearly revealed that the highway, acting as a connection between the city of Baku and the southern regions, still poses a significant barrier to connecting residents to Flag Square. As a result, there is limited access to the renewed area that affects its usage.



The transformed zone, transitioning from an industrial area to public space, covers an estimated 1 km². The ongoing renewal process in the Industrial Waterfront Area is primarily centered on beautification with a little incorporation of social and environmental aspects into the economic evaluation of the space. The renewed site, initiated since 2015 invests in an area that attracts relatively few people. Therefore, during the unstructured interactions with stakeholders (see section 2); the authorities demonstrated a willingness to learn from best practices on how to bring people to the newly created and renewed urban areas.



The former harbor zone has undergone a conversion into a real estate area with a business model primarily centered on beautification. The real estate prices, both before the initiation of the TAC Residences and Port Baku Residences and after, demonstrate a significant shift: in 2009, it was 1200 AZN per square meter, while in 2019; it reached 6000 AZN per square meter (equivalent to 3400 US dollars) [47]. Given its central location, this place has the potential to attract more people compared to the first two examples.

Figure 11. Selected coastal renewal projects. Source: Tural Aliyev, City Administration, Baku White City, 2023.

As illustrated in figure 11, the city of Baku is currently undergoing a renewal strategy with mainly a unidirectional, business-oriented approach [1]. The projects for the coastal areas focus solely on enhancing aesthetics and attractiveness following the Dubaification model [53] [1]. A holistic approach to urban development, moving beyond a mere emphasis on aesthetics and attractiveness, could potentially address the flooding challenges in Baku's coastal urban areas and integrate social and environmental aspects into urban development (see section 7).

7. INTEGRATED URBAN RISK BASED PLANNING: BEYOND UNIDIRECTIONAL ECONOMIC FOCUS ONLY

The process of planning for resiliency delineates a systematic approach to strengthen the resilience of coastal urban areas against the challenges posed by rising sea levels (fig. 12). The process initiates with a comprehensive examination of scientific assessments, aimed at

understanding vulnerability and risk. Subsequently, an adaptation plan is formulated, and measures are implemented and monitored to ensure their effectiveness.

The planning process for resilience, as elaborate for California, provides a basis for the conceptual framework for Baku's coastal urban areas as depicted in figure 14. Several process steps are borrowed, including *Review Science* (as outlined in the theoretical section concerning resilience, vulnerabilities, and natural variation cycle fluctuations), or *Assess vulnerability* and risks (as demonstrated in flooding scenarios and challenges related to coastal urban and industrial expansion within the context of Baku's coastal renewal strategies). The integrated urban framework proposed in this article (fig. 14) also follows and aligns with the fourth step of the process of planning for resiliency (*Development Adaptation Plan*).

Figure 12. The process of planning for resiliency of coastal urban areas, San Francisco Planning, 2016.

In addition to mapping environmental risks and vulnerabilities in urban areas, adapting to flooding in the coastal urban areas of Baku could also benefit from an integrated approach to risk processing in urban areas, drawing inspiration from the Swiss example. The conceptual framework presented below is characterized as a comprehensive and holistic approach that extends beyond a one-sided economic profit focus (unidirectional approach) (fig. 13).

The illustration below exemplifies (fig. 13) the principle that when determining the optimal action plan, all conceivable measures for preparedness, response, and recovery should be taken into consideration. Given the fluid boundaries between these three domains concerning the actual measures, seven more detailed subdomains are outlined: prevention, emergency provisions, preparations for intervention, intervention, reconditioning, event analysis, and reconstruction.

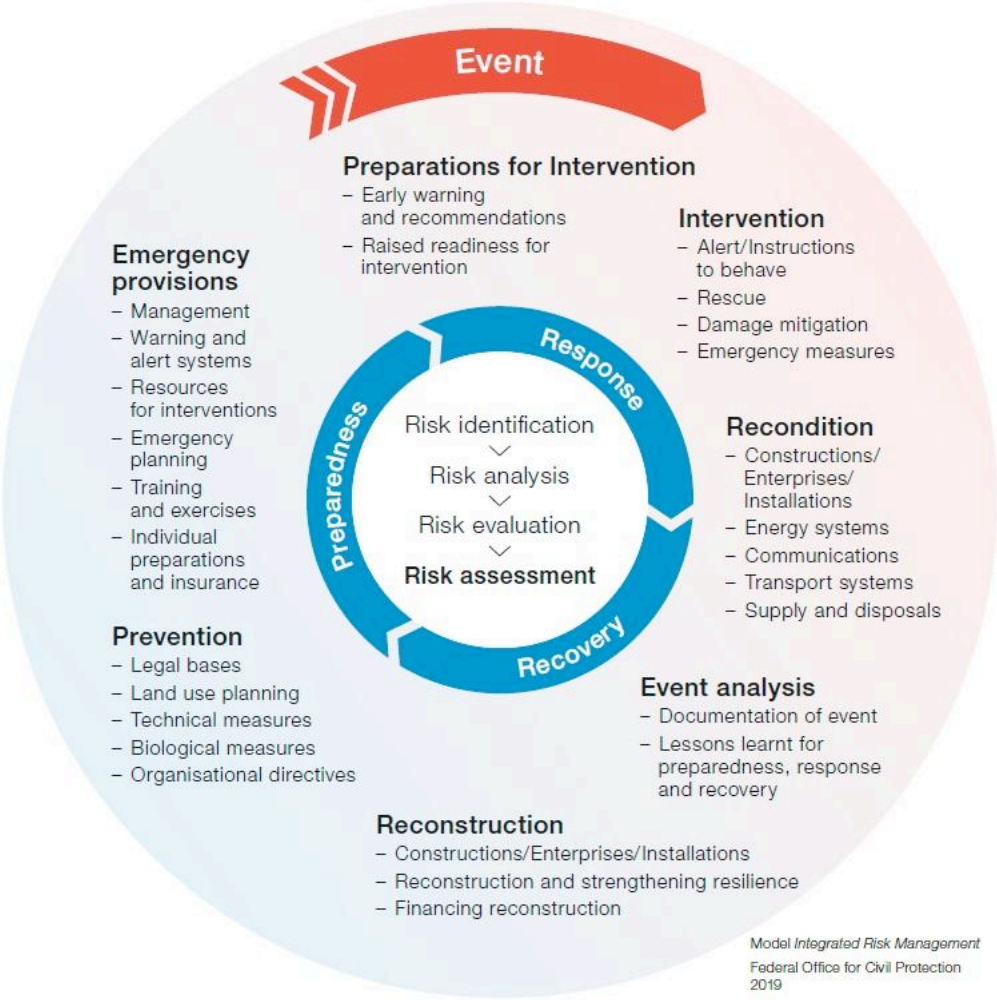


Figure 13. Integrated Risk Management. Swiss Federal Office for Civil Protection, 2019

Inspired by the Integrated Reflective Cycle [9], figure 14 incorporates elements from models outlined in figures 12 and 13. It guides through four steps, involving the consideration of experience, actions, relevant theory, and preparation for the future. By reflecting on these four steps, the article derives an Integrated Urban Risk based Planning (fig. 14) based on the mentioned components.

The experience represents the Method (nature-, engineering-, and/or innovation-based approaches have already been demonstrated, as evidenced by the case studies of the cities of Geneva, New York, and San Francisco) that could potentially be implemented; the actions correspond to the Objective (resilience building); theory aligns with the Aim (comprehensive and holistic approach), and preparation for the future relates to the Strategic Axe.

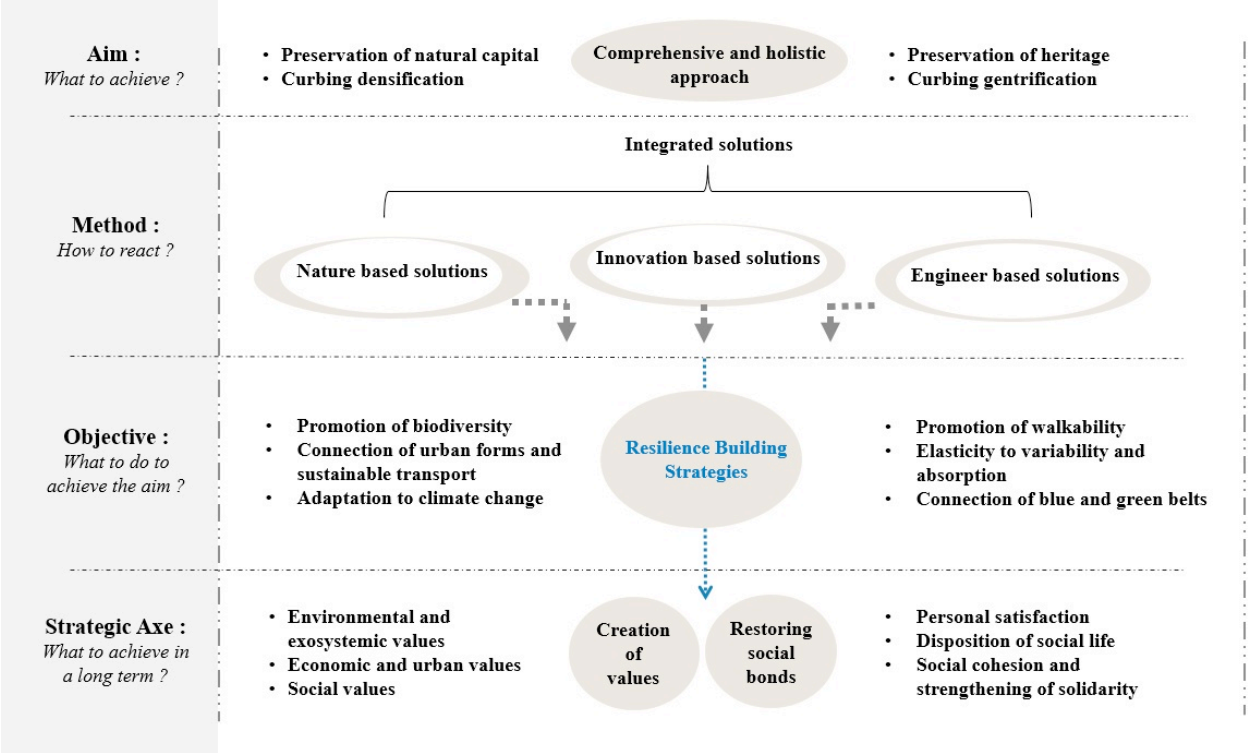


Figure 14. Integrated Urban Risk based Planning. Tural Aliyev, 2023.

The figure 14, labeled as Integrated Urban Risk based Planning, illustrates the integration of risk processing into the planning process. In essence, territorial planning is developed in consideration of the identified risks.

The Integrated Urban Risk based Planning, which is a conceptual framework, aims at integrating social and environmental considerations into the economic aspects of projects. It involves the following steps:

- Firstly, the framework asks about the aims of policymakers and urban planners. It could include elements such as preserving natural capital, cultural heritage, and mitigating densification and gentrification in the coastal area, corresponding to a comprehensive and holistic approach which is characterized as a contrary to the unidirectional focus.
- Secondly, the framework asks about the method on how to react and intervene. It could integrate combined methods such as nature-, engineering-, and/or innovation-based approaches as presented in this article.
- Thirdly, the framework asks about the objective on how to achieve the aim. The objective is to enhance the resilience of coastal areas against flowing. To achieve this, the framework suggest incorporating elasticity to variability, absorption, adaptation to climate change, promotion of walkability and biodiversity, and the integration of urban forms and transportation with blue and green belts.
- Finally, by following these three steps, strategic axes could be established, addressing the question of what to achieve in the long term. It could include the elements such as creation of new values (economic, social and environmental ones), restoration of social bonds, and promotion the health and well-being of its citizens over the long term.

The Integrated Urban Risk based Planning is intended to support Baku City General Plan 2040 [7] that should help bolstering the resilience of coastal areas. It aligns with the Sustainable Development Goals (SDGs), particularly within the context of Disaster Risk Reduction as a component of Urban Development for Coastal Areas. The Integrated Urban Risk based Planning corresponds to Target B1 of SDG 11, which measures the proportion of local governments adopting and implementing local disaster risk reduction strategies in accordance with the Sendai Framework for Disaster Risk Reduction 2015-2030 [52]. Particularly, it addresses the priority on enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery,

rehabilitation and reconstruction of Sendai Framework [52]. This method is also in line with other SDGs such as, e.g., SDGs 3 on healthy lives and promotion of well-being, SDG 8 on promotion of sustained, inclusive, and sustainable economic growth, SDG 13 on taking urgent action to combat climate change, and SDG 9 on building resilient infrastructure.

8. DISCUSSION AND CONCLUSION

This article discusses Baku's current coastal resilience challenges related to the fluctuation of the sea level and demonstrates potential flooding scenarios in coastal urban areas. It delves into the risks associated with Baku's ongoing coastal renewal projects based mainly on an economic focus with little consideration of sustainability and resilience elements.

Based on the employed methodology, the article emphasizes that the primary reasons for the limited attention to a sustainable and resilient approach in coastal urban areas include the division of littoral areas among various public entities, the absence of disaster risk reduction strategies for coastal areas at different levels — ranging from city to regional to national levels —and a shortage of localized knowledge and best practices from other cities in building resilience in coastal areas. The proposed framework aims to address the absence of two crucial elements by recommending a comprehensive and holistic approach (multidirectional) to disaster risk reduction, particularly concerning strategies for coastal flooding at the city level. It also seeks to underscore the significance of localizing best practices from other cities within the context of Baku to enhance resilience in coastal areas.

The article underscores the significance for incorporating considerations of sustainability and resilience in waterfronts and underscores the significance of transcending a unidirectional urban renewal approach based on economic (short-term) benefits only. The article outlines the components of Integrated Urban Risk based Planning, a comprehensive and holistic conceptual framework tailored for coastal urban areas. The primary objective is to enhance the resilience of Baku's coastal regions. The Integrated Urban Risk based Planning aims at integrating social and environmental considerations into the economic aspects of projects and outlines steps for enhancing coastal resilience to natural hazards within coastal urban areas. It proposes here holds the potential for practical implementation and requires testing and refinement, emphasizing that it is a work in progress. Such testing and refinement processes correspond to the fifth step of figure 12, as part of the implementation of adaptation plan.

In addition to the political willingness for the implementation of the Integrated Urban Risk based Planning, further conditions are needed for its sustainable realization. New sets of data, tools, forecasting, and scientific advancements could help to assess risks, challenges and vulnerabilities. Moreover, community engagement is vital for co-monitoring the implementation of the adaptation plan (sixth step of figure 12). This approach is designed to meet the needs of the population, fostering a sense of ownership and collective responsibility in shaping the future of coastal regions. Furthermore, fostering interdisciplinary approaches and encouraging the emergence of expertise from various sectors is essential for the implementation of the framework. In tandem with this interdisciplinary approach, it could be important to build new sets of expertise, breaking down silos and integrating knowledge from diverse fields. In addition to figure 12 and 13, the proposed Integrated Urban Risk based Planning (figure 14) aims to elucidate the strategic steps and their intended purposes that should be taken, along with identifying additional targets it could respond to, all while maintaining a focus on the overarching goal.

In conclusion, localization is more important than ever to adapt to local context, and territorial planning is crucial in handling the distribution of the population at the national level to reduce risks associated with high-density coastal areas of Baku and concertation of strategic infrastructure. Besides, a resilient and sustainable city has the potential to positively influence real estate prices and foster tourism development. This aligns seamlessly with the ongoing

efforts of Baku's authorities in their coastal renewal projects, reflecting a strategic focus on sustainable urban development for long-term economic prosperity.

In future research endeavors, it is crucial also explore the implications of decreasing water levels on coastal urban areas. While the current literature predominantly focuses on addressing challenges related to sea level rise and developing adaptation strategies, investigating the potential impact of sea level decrease on coastal urban planning and formulating appropriate strategies becomes particularly significant. This importance is underscored in the case of the Caspian Sea, where evidence indicates a potential decline in its water level. Such a decline that could be unexpectedly followed by a rapid 2.25-meter increase over two decades, as it happened after 1977, raises significant concerns for coastal areas. Coastal urban strategies for adaptation, especially in the case of Baku and the Caspian Sea, need to consider both rising and falling sea levels for comprehensive planning.

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IDENTIFYING THE EVOLUTION MOBILITY TRACE IN TEHRAN METROPOLIZATION PROCESS

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ABSTRACT

Rapid population growth is occurring in cities across the world. Urbanism scholars recognize the general process of urbanization without form, limits and consideration for the natural environment, as the fourth urban revolution, termed metropolization. Accordingly, many neologisms have emerged, clearly reflecting changing boundaries, morphologies and scales. Metropolization is not just a phenomenon of evolution in the large cities, for it is also a process that brings into the daily life operating area of the large scale. Tehran metropolitan area is no exception to this, with the city being a sprawling and fragmented area. The roots of this can be traced back to the political systems of development, which have impacted greatly on the population and the environment. In particular, the transport system has not been developed in line with the population growth in the metropolitan area. This is the result of a lack of attention towards public transport, as well as urban planning choices driven by politicization and clientelism. To understand the complexity of this process, we need to uncover all the interrelationships amongst the transport system initiates and maintains the relation between urban spaces, which are strongly impacting the palimpsest of the urban evolution.

Key words: *Public transport, urban sprawl, metropole, clientelism, politicization, Tehran*

INTRODUCTION

Rapid population growth and transformation are occurring in cities across the world. Urbanism scholars recognize the general process of urbanization - without form, limits and consideration for the natural environment – as the fourth urban revolution, termed metropolitization [17] This is the result of different complex processes of multiple urban transformation and transition, which need to be studied in the historical context. Accordingly, many neologisms have emerged, clearly reflecting changing boundaries, morphologies and scales of human settlement patterns [13]. Metropolization has led to the re-territorialisation phenomenon. According to François Ascher [1], it is not just a phenomenon of growth and evolution in large cities. It is also a process that brings into the daily operating area of the large scale, towns and villages more and more far in terms of distance and which generates new types of urban morphologies. These processes are characterized by a completely new ratio between built and open space [10], as well as between permeable and impermeable surfaces [28], which are connected by a different model of transportation system in over time. To understand the complexity of this process, we need to uncover all the interrelationships amongst the transport system and urban spaces, which have strongly impacted the palimpsest of urban evolution. As a consequence, the palimpsest notion means reading the construction of space not only as an incremental accumulation of traces, but also as a series of processes: through the dimension of time, what has been added, what has been transformed, and what has been erased [15].

The Tehran metropolitan area is no exception to this, with the city, in keeping with this model of development, being a sprawling and fragmented area [21]. The roots of this can be traced back to the political systems of development, which have impacted greatly on the population and the environment. In particular, the transport system has not been developed in line with the population growth in the metropolitan area. This is the result of a lack of attention towards public transport,

as well as urban planning choices driven by two different models of political clientelism before and after the Islamic revolution. The politicization of urban planning and the current territorial development doctrine have created distortions in the re-territorialisation of Greater Tehran. In this context, the diagnostics and analysis of the relation and gap between urban practices and policies will uncover the reality of urban transformation. Specifically, the mapping tools utilized will allow for exposure of the dynamic of urban evolution processes on the macro and micro scales that cannot be effectively revealed by static models. This paper is aimed at theorizing and conceptualizing a development model for the metropolitan area of the Iranian capital after exploring the interactions between spatial, social and environmental processes through the prism of the temporal dimension.

1. TRANSPORTATION PALIMPSEST IN THE METROPOLIZATION PROCESS

In the 1983s, Corboz, described territory as the result of multiple processes of transformation. Accordingly, he drew attention to the long history of places, focusing on the historical elements, such as the signs, traces and voids and their relations with each other over time. This resulted in the notion of "territory as a palimpsest" in territory diagnostics [16] and the analysis of the metropolization process is no exception to this reality. It should be identified through the single transformation elements like plots, buildings, road networks, etc. Such investigation should consider the influence of time in local and territorial evolution that is subject to three categories of transformation: permanence, persistence and disappearance [24]. Population growth as permanent demand for transformation has occurred in cities across the world. Urban mobility as persistence needs by using the different transportation model, which is depending on innovation and capacity of each period, influence the palimpsest of urban development. Under this perspective, the emergence of public transport, followed by the appearance of the car allowed the inhabitants of cities to settle in places previously inaccessible on foot [14]. The car not only allows activities to develop further away from the city center, for it also changes the need for proximity between different functions [29]. The historical cities were built densely but the new model of transportation that was based on motorization changed the city destination in terms of development. The new model is based on low density, decentralization and dispersion; it is the period of peri-urbanization [22]. Initially, in the majority of cases, the new urbanization area, named as suburban and satellite cities, corresponds to small villages. Farm land surrounding these villages has been changing its functionalities due to pressure from the demand for homes and also land speculation [32]. The new urban form [3] caused several changes by using the new transportation model that is based on cars.

- Change in the urbanization area (horizontal and vertical);
- Change in the average duration and mileage of mobility;
- Change in the distribution of jobs and population.

Rapid population growth and transformation have been recognized by urbanism scholars as the general process of urbanization, without form, limits and consideration for the natural environment. The fourth urban revolution, termed metropolitization [17] is the result of different complex processes of multiple urban transformation and transition, which needs to be studied in the historical context. Accordingly, many neologisms have emerged, clearly reflecting changing boundaries, morphologies and the scales of human settlement patterns [34]. Metropolization has led to the re-territorialisation phenomenon owing to the transition from industrial society to a post-industrial one, which involves technical, economic and social transformations [27]. The concept of metropolis was used to characterize large cities subject to rapid urbanization, which has resulted in a new relation that is essentially based on capturing flows between the mother city and the suburbs [25]. The metropolization process results the change in the external structure of metropolises, which is permitted to enter in a global city network. In addition, there is a change in the internal structure, which takes on a spread and multipolar form [5]. Metropolization is not just limited to urban sprawl [19]. For some researchers, it can be defined by using different aspects of

concentration: men, capital, tangible and intangible goods [12] as well as economic and political decision-making [9]. The daily practices that need mobility influence metropolization. The definition of François Ascher [2] comes within this perspective: Metropolization is not a simple phenomenon of urban growth. It is a process that brings cities and suburbs further and further into the daily functionality area of agglomerations, which generates new urban morphologies. The metropolis is not only composed of the main city and the suburbs, the mobility result from infrastructure and also the social dynamics that exist in transportation are part of it [22]. The transportation system must be understood as a major component of the metropolitan area, capable of transforming it. These mutations can lead to territorial fragmentation as follows.

- **Spatial**: which is defined by the weakening of the physical relations between the different parts of the territory. This leads to an urban juxtaposition [11].
- **Political**: which is defined by the boundary. As a result, there is no coincidence between functional and institutional spaces.
- **Economic**: which is caused by the distribution the number of places of work and the number of resident populations in each part of the city `31].
- **Social**: which not only refers to the process of social dualisation and inequalities, but also, corresponds to the disappearance of the city identity that pertains to its inhabitants [23].

Also, the transportation system is often seen as a cause of territorial development [6]. Some researchers defend the view that development and improvement in transportation systems can increase the mobility of goods and people that promote trade and economic growth in the region in favor of metropolization process [8]. From this perspective, the relationship between the economic aspect of the metropolitan area and the transportation system, must maximize mobility benefits and minimize costs [33] by improving speed, decreasing travel time [4] and providing an accessible offer for all people. Accordingly, the transportation system should aim to manage effectively the flow of traffic in the metropolitan area [7]. In this context, the construction of transport infrastructure, like railways, is synonymous with development and integration, allowing the mobility of goods and people [6] as recognizable in palimpsest of transportation development up until today. On the other hand, other researchers take a different point of view, that: the notion of the direct relation between development and transport infrastructure is difficult to verify and perceive that there be the possibility of an acceleration of the economic aspects of the metropolitan area, without leading to development. Lo Feudo [26] states that it is impossible to predict that the expansion of transport infrastructure will favor the development of underdeveloped regions. Plassard [30] puts forward a third idea. This author argues that consequences relating to the infrastructure cannot be made by the observation of only the economic aspects, for it is the social, economic and spatial change in totality that must be perceived. He states that transportation infrastructure could not bring the development automatically but would only accelerate development. In conclusion, the transport infrastructure system, such as rail transport, is an opportunity to make development more than being a cause of it and it is one factor among others.

2. HISTORICAL TRACE OF TRANSPORTATION IN THE TEHRAN METROPOLITAN AREA

Tehran, as the political and economic capital of Iran, enjoys a central position in the Iranian urban network. The removal of international economic sanctions, in early 2016, has given a new agenda to the geopolitical position of the city to becoming a global city, the metropolis of Tehran, which is the largest city in the Middle East, is located between the foot of the Alborz Mountain range and Kavir desert in north-central Iran.

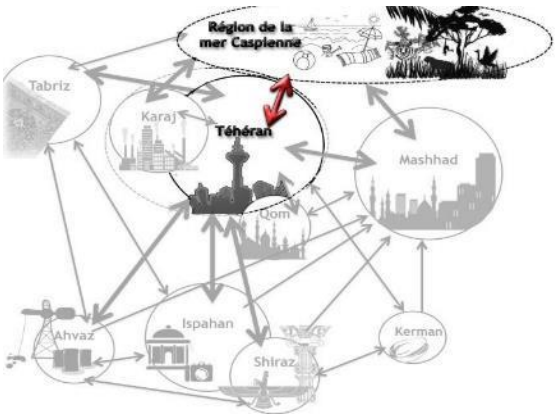

Figure 1: Tehran in the center of Iran urban network
Source: Alireza Hashemi Behramani, 2015

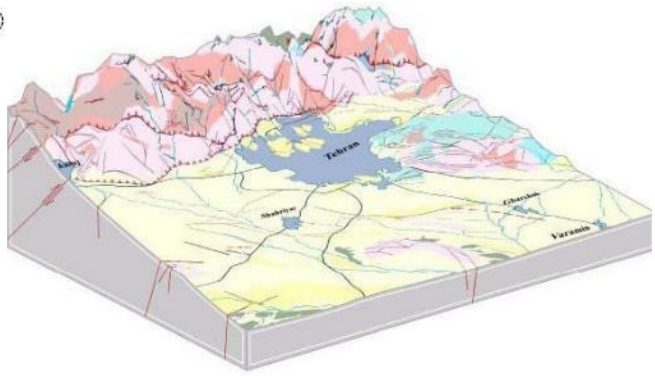

Figure 2: 3D model of Tehran position
Source: Atlas of Tehran, 2005

2.1 From traditional urbanization to imitative urbanization

It is a relatively new city compared to other major Iranian ones, being originally a small village in the north of Rey, an ancient Persian city. Until the eighteenth century, Tehran was a large village characterized by farms, orchards, springs, streams and wonderful landscapes. The decisive moment in the evolution of the city occurred in 1789, when it was established as the capital of Iran due to the military reason of its strategic position. It is equidistant from major provinces, like Azerbaijan, Khorasan and Isfahan. That means the advantage of good accessibility, to control the country, encouraged the density of Qajar to choose Tehran as capital. As shown in the figure 3, the city of Tehran was an isolated city which had the political and military importance. Figure 3 shows the village of Shemiran in the north with an important mosque, the village of Karaj located on the silk road and the city of Rey in the south, with historical mosques that have importance for the Shiites.

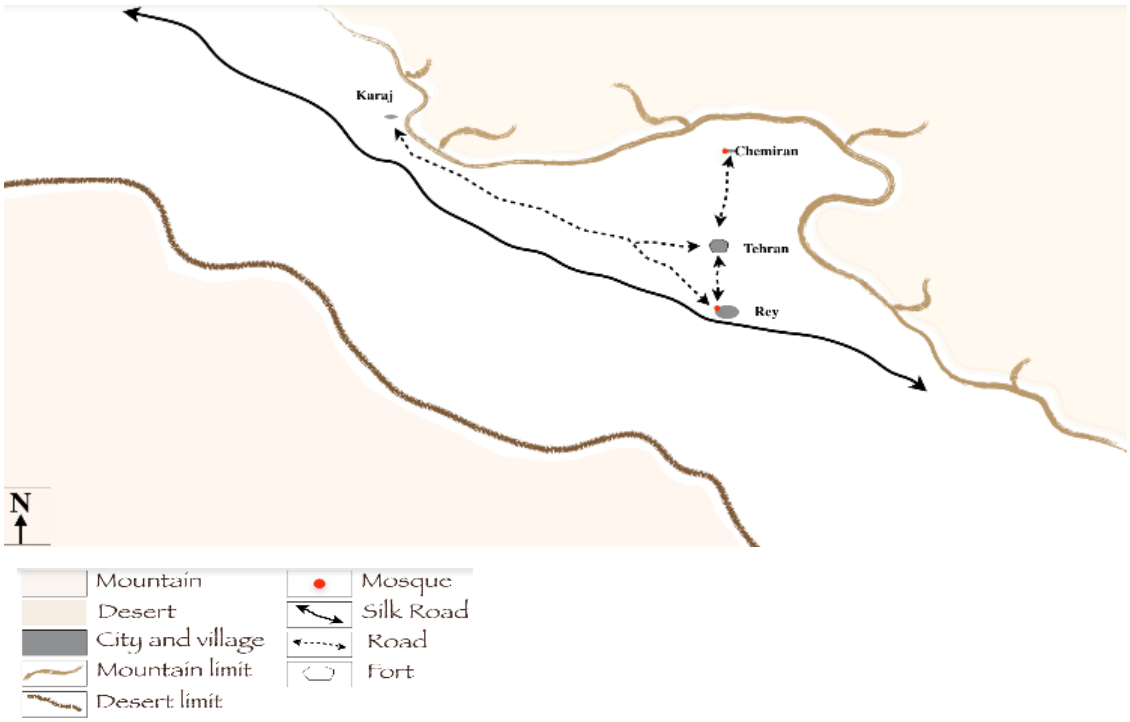

Figure 3: The Region of Tehran until 1786 Source: Alireza Hashemi Behramani, 2017

In 1842, the first map created by Mr. Berezine, a Russian tourist, shows the urban organization of Tehran. It is surrounded by a fort with five gates to assure the connection of the city to other parts of the country. We find there the citadel (political power), the mosque (religious power) and the different neighborhoods. The city was developed in the interior of the fort. Despite a rising

population, the Iranian capital still looked like as small, traditional provincial town, where traffic was scarce and almost impossible, because of the narrow pedestrian streets. In 1883, the king asked a Belgian company to construct the first railway line in Iran, which was to connect Tehran to Rey. This development was founded on religious grounds, because, as above mentioned, Rey is the location of important mosques for Shiites. The users named these trains Machin Dodi. This line is 7.8 km length with two stations named by passengers Gare in French, because the line was constructed by a French-speaking engineer. Today Iranians use Istgah for the station, which means the place for stopping. The Machin Dodi contract covered just one page for this important development, but it is very interesting to note that it had an environmental dimension. It asked the Belgian company to protect trees in the layout of the building and to plant trees along the way. The population did not accept the new technology, but the king forced the governors to use Machine Doodi. It was developed by European company. It had a capacity for 60 people and the price was between 10 and 15 dinars. In the interior of the city the inhabitant moved by 4 lines of tram that move by hours. The car came to Tehran in 1890 through rich families, which created the need to have streets. For that reason, the new street was constructed, and it changed the structure of historical urban fabrication. In addition, the demand for housing for new inhabitants led to the city manager demolishing the fort and building a new one in order to grow the area of the city. As other fortress city in the world, the place of the demolished fort, occupied by the road that was adapted for the movement of the car. New urban development was made in a northerly direction, despite the existence of the Rey in the south and also the transport facilities due to the train line, which connected Tehran to Ray. The silk road lost its importance eventually in reason of changed in the practice of mobility in the world. Karaj remained as a village, in the way, in the direction of Qazvin and Tabriz.

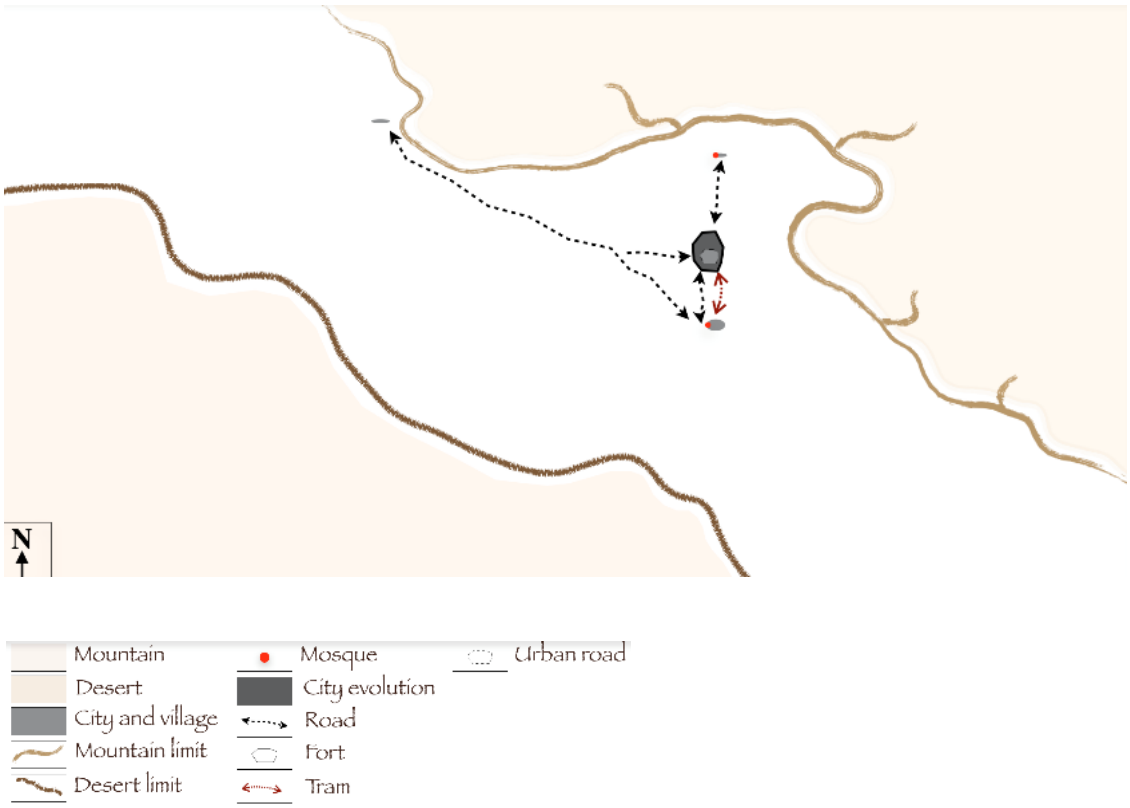

Figure 4: The Region of Tehran until 1886 Source: Alireza Hashemi Behramani, 2017

During the reign of Reza Shah Pahlavi (1923-1941), the city started a new transformation in the form of a Western capitalist model. The first urban development policies were underpinned with a strong ambition to modernize the city in the same style that Haussmann had laid out in Paris. [21] Bazaar as an economical place lost its attraction. The new shops, boutique, developed behind the street as a new model of business. For example, as with the Champs-Élisées in Paris, Laleh

Zar1 Avenue became the place of boutiques, cinemas. It became the place of modern activities. The fort was replaced in 1930 by the urban boulevards to improve the connection with the new urban area:

- **Tajrish**: Reza Shah chose the village of Tajrish in Chemiran, located near a mountain that gave a favorable climate to this area, as the future place for the governmental palace of decades of Pahlavi. Subsequently, the big families also started the construction of summer residences there. The king knew the importance of the transport network. Accordingly, in 1922 he began building the longest avenue in the Middle East and one of the oldest roads in Tehran to connect the palaces in the north and south. The road was named Pahlavi, but following the Revolution, it was given the new name of Vali-Asr. The Pahlavi Road development is an example of clientelism activities in the city. The new urban infrastructure limited by trees planted as an environmental dimension.2 The facilities come from road infrastructure, the best climate in the north and also available water as historical reasons, which encouraged the development of the city in the north direction.
- **Rey**: To the south near the desert, with its historical and religious importance, began to lose its attraction as a result of the decline in economic investment of the Pahlavi decades in this part. History researchers point to the adverse climatic conditions for this choice, but we argue that Reza Shah's Islamization policy was the main reason to lack in Ray's development. The tram that was built to connect Tehran and Rey owing to lack of investment began to lose its functionality in 1955.
- **Karaj**: From 1935 onwards, Karaj took on the role of a link city following the beginning of the construction of the Chalus road that connects Tehran through Karaj to the north of Iran. Chalus is the curved way that traverses the Alborz mountains to rich the Caspian Sea. There are two important aspects of this development: its innovative technology and the reduction in the connection distance between the north and south of Iran. The Caspian Sea region has a salient role in agricultural production. The mobility and road connection changed the destination of Karaj urban development.

2.2 Urban modernity dreams

The urban development model that was first encouraged by the Pahlavi formed the basis of social fragmentation in the capital. The rich people installed themselves in the north to profit from the good climate and the poor could only afford to live in the south near the desert. This fragmenting continues to this day. The wealth from oil greatly enhanced the economy of the capital and people from rural areas and other cities were attracted there for work and other opportunities. This phenomenon has led to rapid and uncontrolled urban growth. Tehran's urban sprawl was characterized by the demolition of the garden, until today, into industrial and residential areas. At this time Tehran appeared as a symbol of the recent development of Iran, as a tangible sign of the Westernization of the country [21]. It must not be forgotten that this was the beginning of the development of the rail network in Iran, which was started after the decision to locate the station by Reza Shah in the south and outside the city limits of Tehran. This network improved the east to the west transport axis of the country. Having the train network was very important for Iran's development, but unfortunately, at first, the reason for its construction was so that foreign countries could carry out colonialist activity. Train development is one example of politicization in urban development. In 1912, the first buses started to provide services for Tehran's inhabitants. This became a successful mode of transport and in 1952 the municipality created an organization to control the bus activities which had 173 buses running along five routes.

To control the accelerating expansion of Tehran, a master plan was planned with vision to create an international metropolis. This plan was launched in the early 1960s and implemented in

[1] Nowadays, Laleh-zar is an old avenue in a district of the old city center, where there are the shops selling electrical appliances on a national scale. All the great cinemas, boutiques and etc. don't exist anymore, but Leleh-zar in informal language use, means the place to have some fun.

[2] It is a tree-lined street that forms the green corridor north-south in Tehran. Today the trees, nearly 100 years old, give the special aspect of this road. This model of road development, on a smaller scale, is found across villages in Iran.

1969. Due to topographic constraints (mountainous regions of the east and north), it provided a linear city development at the foot of the Alborz mountains, from west to east. However, the development of the city is reversed with an increase in north-south ax as historical development which was based on ecological axes in Tehran. The modernist plan was for a motorized development based on the creation of intra-and inter-urban highways, which connect 10 new center suggestions for the city. As with the Los Angeles urban development model, a zoning system was proposed based on the separation of functions. The vision was to limit the population to 5 million inhabitants after 25 years. At the time, Tehran had 2.7 million inhabitants, it should reach 6.5 million inhabitants after 25 years in 1994.

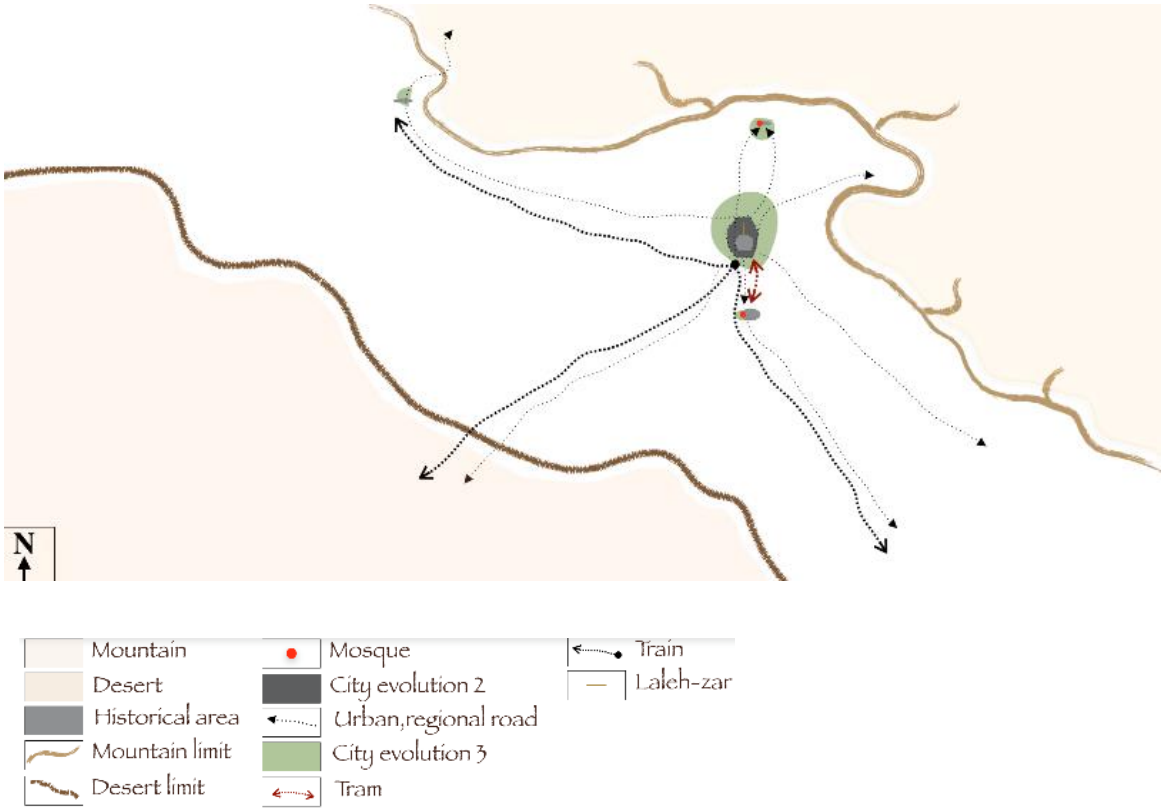

Figure 5: The Region of Tehran until 1955 Source: Alireza Hashemi Behramani, 2017

As development of Tehran follow American urban development models, it is twinned with Los Angeles. It should also be mentioned that the first comprehensive plan was prepared by a collaboration between the Iranian company FarmanFarmayan3 and an American company managed by Victor Gruen4.

In terms of transport policy, for the first time, after the implementation of the first master plan, the municipality prepared a comprehensive transportation plan. It provided for the creation of a transport network based on highways development around the ancient city. To this day, this plan has played a central role in the development of the road network in Tehran. In the same period, the Planning and Budget Organization collaborated with the Municipality of Tehran to build the metro network. Eventually, they asked the French company Sofretu to prepare for its development. The first preliminary studies in 1974 proposed the construction of seven lines. Despite the existence of metro development plan, the city has been built for the car until today.

[3] Abdol Aziz Farmanfarmaian was born in Shiraz at 1920 and he died at 2013 in Spain. He was an Iranian architect who was educated in Franc. He was a member of the Qajar dynasty.

[4] Victor David Gruen was an Austrian-born architect, 1903-1980. He was known as a pioneer in shopping mall design as symbol of modernity in the United States.

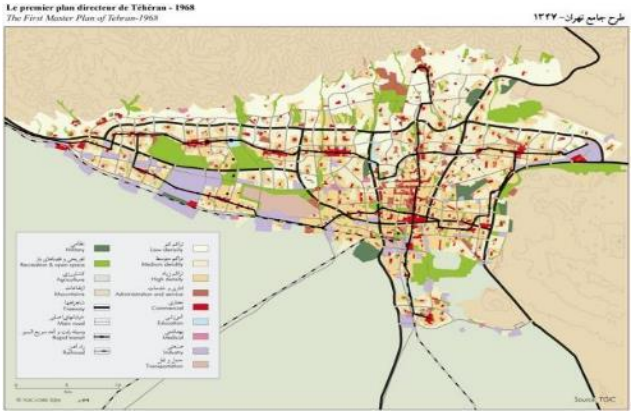

Figure 6: The first master plan of Tehran
Source: Atlas of Tehran, 2005

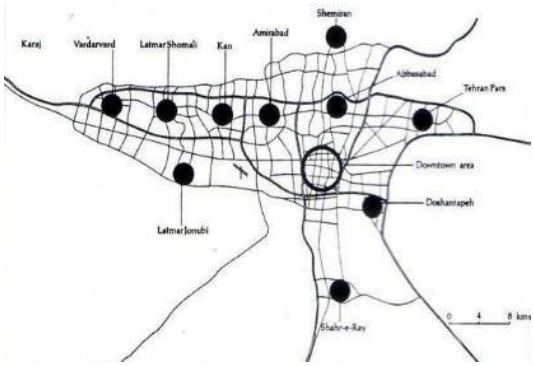

Figure 7: The centers and road network

Industries were developed in the city based on zoning of the master plan along major roads that connected Tehran with other cities. For example, in the south, towards Rey, are the most polluting factories: brick factories, oil refineries, etc. To the west, towards Karaj, a beautiful industrial area was developed very quickly, well served by water and energy from the Karaj valley, and easily accessible by the highway. Iran Khodro, as symbols of the car production in Iran, was launched the Peykan production on a large scale. Following the proposal of the master plan, the municipality launched a project for the development of highway networks. The first highway connected Tehran with Karaj and the second improved the link between Tajrish and central Tehran in favor of the rich families living in the north, who could afford cars. North-center highway improved accessibility to center of the city as the figure of an international urban center. The highway development led the inhabitant to live far from the center. The highway led to sprawl in the north of Tehran and also in Karaj. During this period, in 1925, Tehran airport that was located next to the old road that connects the city with Karaj and this represented an important symbol of the country's development. Following the importance of international relations for the decade of Pahlavi and also the strategic location of Tehran in air transportation system, the idea of developing a new airport with an objective to create an air hub was launched. The new airport should construct in south of Tehran in desert area. The attraction of Alborz mountains, in the north of the city, led to the creation of the first gondola lift line in Iran in 1977. The industries that settled in the suburbs of Tehran radically transformed the geography of the Iranian metropolis [21]. This pole of the metropolitan economy gradually attracted the middle and upper classes. In parallel with the development of Tehran, the city of Karaj owing its accessibility, was offering attractive land within a short distance of the industrial zone of Tehran and this began its development as a satellite and link city. The Tehran boundary of development increased the value of land in the city, in consequence finding the home in the city became inaccessible for the inferior social class in terms of money capacity. This class chose to construct homes illegally outside of the city limits and also in the villages far from the city. In terms of urban traffic, Tehran faced a substantial increase in the number of car journeys in the city. In order to maintain the fluidity of traffic circulation the municipality built bridges at road intersections. They were constructed as a temporary solution, but they still exist today in the transport network of the capital.

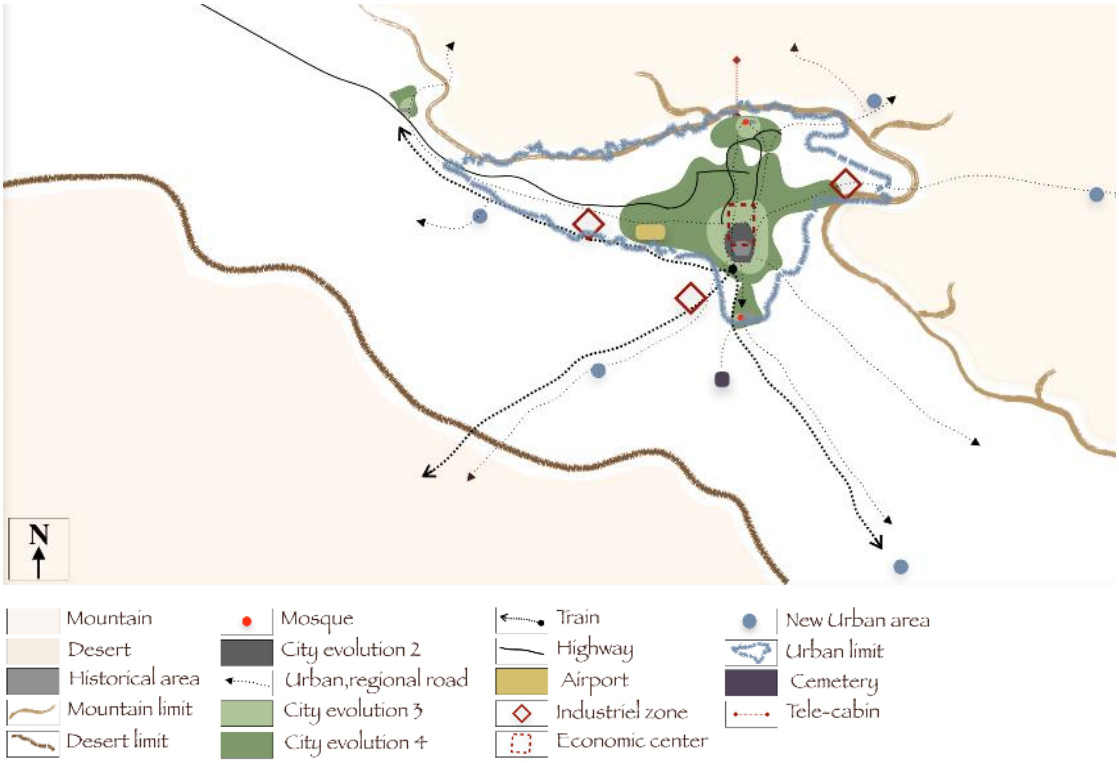

Figure 8: The Region of Tehran until 1980 Source: Alireza Hashemi Behramani, 2017

By reached 1974, the real estate crisis due to the oil shock displaced, impacted Tehran. The working classes, in reason of economic problems, lived in the southern outskirts of Tehran. This unplanned movement towards the metropolis intensified with the 1979 revolution and the subsequent 10 years of war with Iraq. The new municipality was now occupied by revolutionary management that abandoned the first master plan. Hence, people had the freedom to build without any constraints, wherever they could find suitable land. The villages in the south of Tehran near to the desert area continued to attract the working- and middle-class population that had chosen to come to the capital to find jobs. The urbanization of the Tehran region had intensified. Housing was built on squatted land or purchased without any legal formality, which led to sprawl. The urban sprawl changed Tehran's destination, it made new demand in terms of city management that was based on the large scale. In 1987, after Ayatollah Khomeini's death, Iran faced a new post-revolutionary period. Hashemi Rafsanjani, president of Iran and the closest person to the Ayatollah, launched the development of Iran. He knew well that the development of the capital could influence the whole country and for that reason, he gave strong backing to the mayor of Tehran, who was chosen by the interior ministry. He gave permission to the mayor of Tehran to participate in all governmental council meetings with the objective of solving the capital's problem easily by direct coordination and cooperation between ministries.

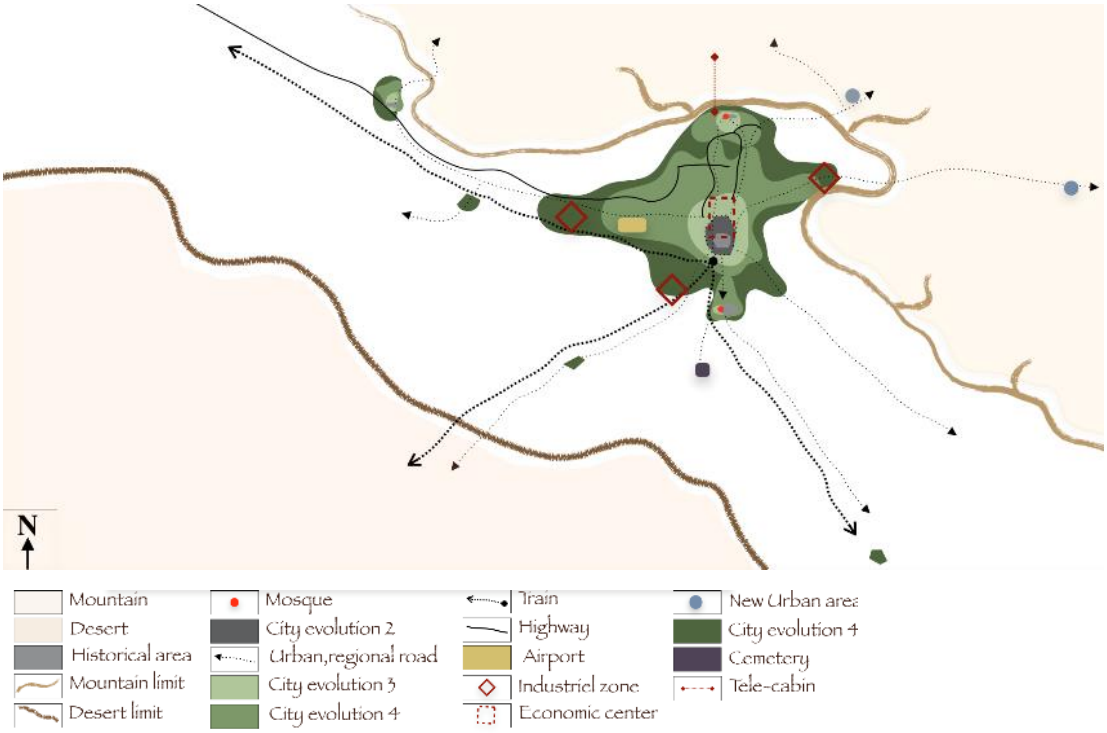

Figure 9: The Region of Tehran until 1990 Source: Alireza Hashemi Behramani, 2017

2.3 Master plan failure and Project-based development

Tehran continued its development until 1992, when a new master plan was made by the Iranian company. The ministry of housing demanded a new master plan for a metropolitan area of Tehran in the new context that has completely changed. The new Master Plan considered urban development on the southern periphery, where poor families resided. In comparison with the first plan, the second one has established the largest boundary in the south with the objective to include the illegal constriction that has done until this day in out of Tehran development boundary. Under the plan, four urban centers located in the four geographical orientations of the city were proposed, unlike the first master plan which has mentioned 10 such centers. It tried to limit the development of Tehran city by creating a green belt around it. In terms of the transport network the aim was to keep the same structure of the first master plan. Unfortunately, the master plan was not accepted by the municipality. Karbaschi, the mayor of Tehran from 1987-1995, stated that this plan was imposed by the housing ministry on the city and that the municipality did not have any influence during its preparation [20].

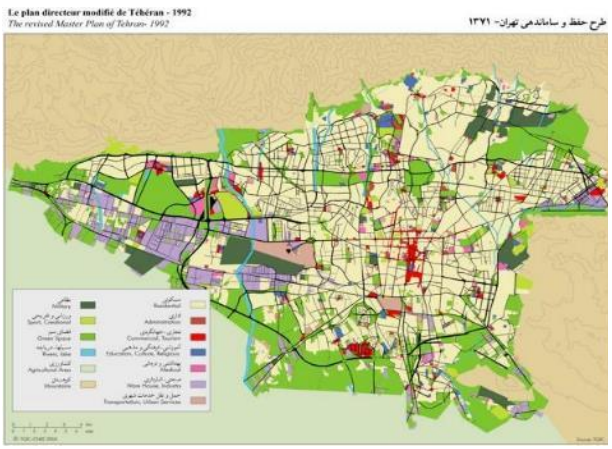

Figure 10: The second master plan
Source: Atlas of Tehran, 2005

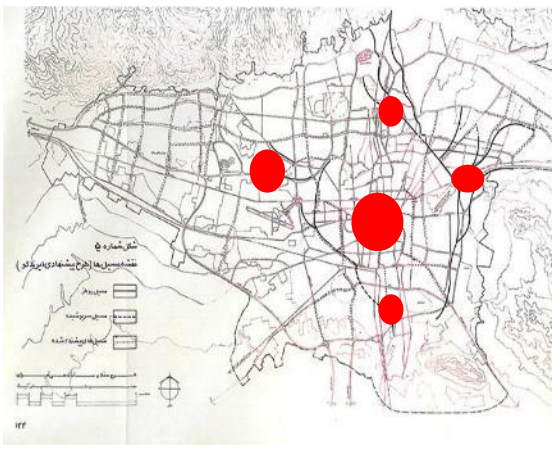

Figure 11: The center and road network
Source : Alireza Hashemi Behramani, 2005

The north of Tehran, the placement of the superior class in terms of economy, has continued to structure itself as a city, with diversified activities. Some areas in the south have been maintained and provide services and urban amenities at the same level as in the center and north of the capital [21]. However, whilst the suburbs have experienced rapid population growth, infrastructure and services have generally not kept up. We can mention the village of Varamin, which as a result of the increase in population, has become a satellite city of Tehran. In spite of the lack of infrastructure and services, it does not function as a dormitory city. Hashemi [20] said that sometimes these peripheries are more alive than the city of Tehran. The community relationships are the reason of this alive. The mobility from this satellite city has only been made possible by private motorized transportation, as the government has not provided public transportation. But the situation in Tehran was different, municipalities for the first time developed electric buses with the objective to provide the facilities for inferior and middle class live in the capital in 1989. Unfortunately, the urban operations did not have a strategic framework to do urban renewal, spatial and social to reduce the huge segregation. The municipality has supported various operations in the city, like the urban renovation project called Navab. This was launched to improve the Tehran highway network on the north-south axis, whilst at the same time offering high quality housing. But the project, despite the benefits anticipated, has created significant spatial and social fragmentation in the city. Urban growth and the significant increase in automobile dependence demonstrated the importance of metro development in Tehran. The construction of the first subway line was started in 1978 in the north of Tehran and progressed at a snail's pace. The metro didn't have any place in the strategic development plan, because the car as a symbol of freedom attracted all the attention. Following the Islamic Revolution and the war between Iran and Iraq, the metro development was scrapped. The context of war, financial problems and the hostility to a development plan that came from western countries, were the reasons for. However, Hashemi Rafsanjani when he assumed power favored reviving the metro and eventually, the project was restarted by using the plans already drawn up during the time of the Shah. It is useful to describe how Hashemi used the various channels available to him in the Iranian political system to convince the stockholder and multi-level actors who were against this project. He began his effort during when he was chosen by the inhabitants of Tehran as their parliamentary representative and subsequently, was elected as president of parliament. He launched the demand for the metro construction, which he promoted at three different levels.

- He asked the metro project from government as a member of parliament from Tehran.
- He argued for the project in higher-level decision-making as the president of parliament.
- He knew that a successful project had to have the participation of the people. To this end, he used his position at Friday prayers as the ritual of capital to launch the demand to have a metro network for the people, arguing for its benefits. He contended that the metro as a transportation infrastructure would help solve the problems stemming from social fragmentation in the city. Prepare a better life for inferior class was the major slogan of the revolutionaries.

At last, the first metro line connecting Tehran to Karaj (satellite city) was inaugurated in March 1999 and opened a new horizon for the latter. As can be seen in the figure 12, the evolution of the highways went at a much greater pace than metro development. Nevertheless, the majority of highways in Tehran were constructed after urban sprawl, they cut existing neighborhoods.

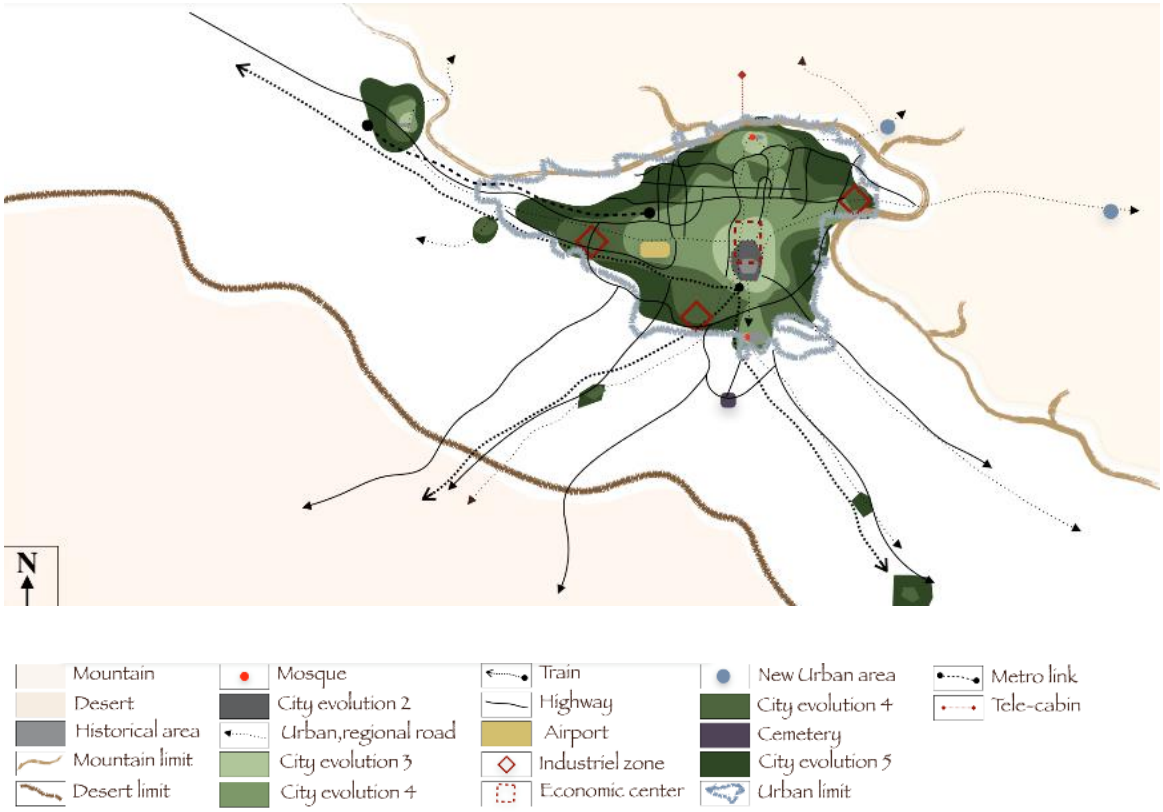

Figure 12: The Region of Tehran until 2000 Source: Alireza Hashemi Behramani, 2017

2.4 The attempt on the metropolitan master plan

Given the lack of a development plan that was accepted by the municipality and the change in urban structure in terms of scale of Tehran Province, the housing ministry quickly prepared the plan named "Tehran 80" for the period of 1996-2001. The Tehran 80 plan (the map of Tehran Metropolitan Area / Tarh-e Majmoe-ye Shahri-ye Tehran), envisioned the city and also, for the first time, all urban territories, on the scale of Greater Tehran [18]. The Tehran 80 plan provided for the creation of new cities outside of Tehran as a decentralization solution. The existing highway transportation system played a significant role in the location of these cities. The planners also proposed the construction of a rail connection to each new city. This plan was approved by the government and also by the municipality of the city, but lack of regulation resulted in the rejection of this plan by the parliament of the country. In fact, by law, city master plans were legal, but the law was silent regarding those on a metropolitan area scale at that time. Whilst the plan was never implemented, it became like a blueprint for the development of the metropolitan area of Tehran. Unfortunately, public transport could not have enough capacity to provide an efficient service to all metropolitan areas. In addition, Teheran faced jobs problem. These two issues encouraged many inhabitants of the city to work as a private taxi driver and the predominance of this mode of transport has continued to this day.

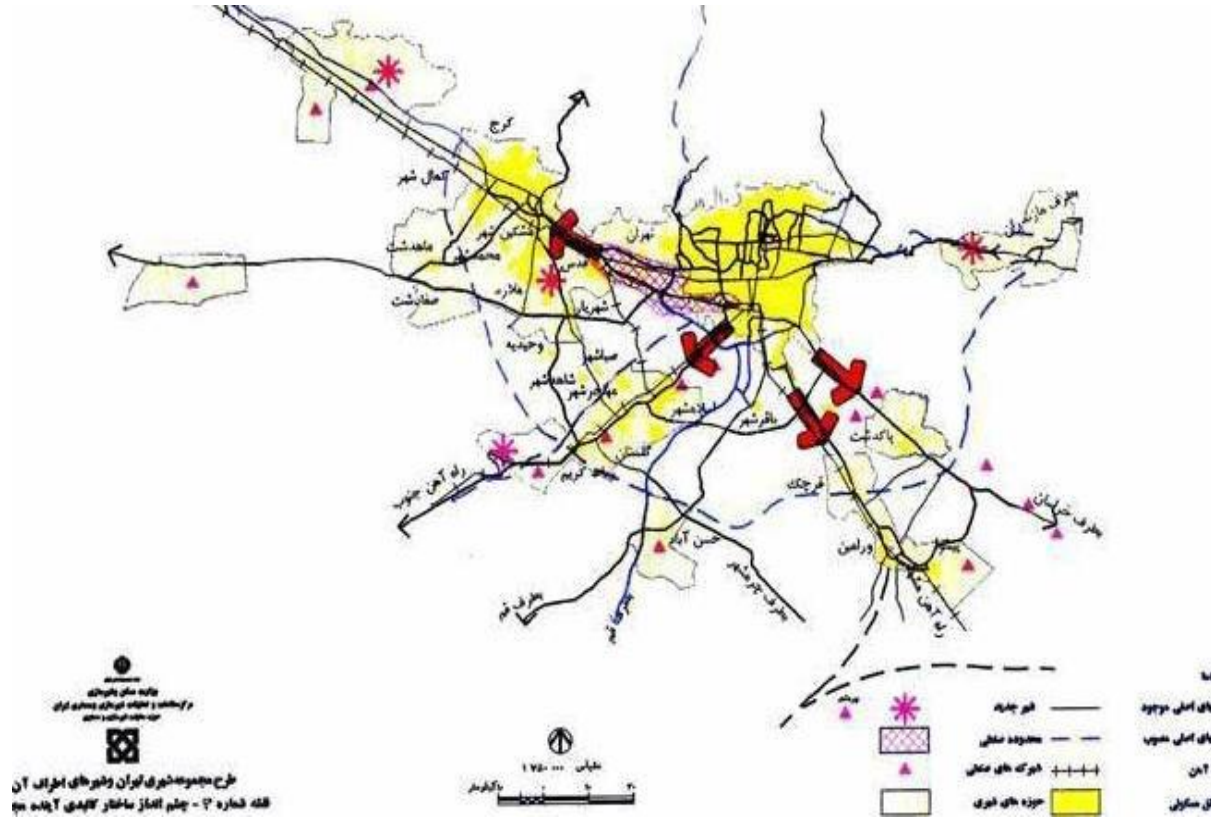

Figure 13: The metropolitan master plan of Tehran Source: Atlas of Tehran, 2004

Greater Tehran or the Tehran metropolitan area is only a convenience of language for the studies conducted by the researcher. For, there is no administrative or financial structure on this scale, and this created difficulties for the Tehran City Hall, which used to be the only entity in charge of all transport infrastructure and services. In this period using the car and highway as transport facilities caused the sprawl in the new cities in the south of Tehran, particularly the Karaj as a biggest satellite city of Tehran. Mohsen Hashemi as director of Tehran metro company declared [20]: Tehran metro was a company that came under the Ministry of the Interior, the bureaucracy model in the ministry as the governmental part decrees acceleration of metro development. For this reason and after much discussion, finally, in 2000 the metro company became a part of the municipality of Tehran. Twenty-five years on from the first rail master plan for metro development, following the metropolitan change and urban sprawl, the French company of Systra accompanied by the Metro Company of Tehran carried out studies on the new modalities of extension for the rail transport network in perspective of 2030. The integration of the metropolitan area into a cohesive whole was the central objective of this plan. It is the structure of the sustainable urban mobility for the metropolitan area that will be improved polycentric organization. There will be four express lines connecting Tehran with satellite cities as well as eight urban lines and five Bus Rapid Transit (BRT) for Tehran itself. The proposed network will have the appearance of what is shown in the map below. The red circles represent the main exchange stations that are to be used for transit-oriented development strategies. The new plan has been approved legally and the metro development is part of a comprehensive plan for reducing the difficulties associated with inter and intra-urban mobility.

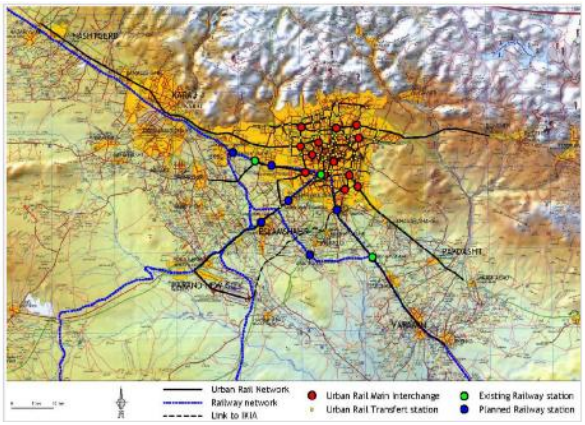

Figure 14: Rail transportation master plan
Source: Master plan of metro, 2007

Figure 15: Tehran metro map today
Source: Site internet de metro, 2018

Unfortunately, the metro master plan has not considered the capacity that exists in the train network connection in the metropolitan area. In fact, the plan just aims to connect the metro network at train stations as an intermodulation model. Master plan of transport developed the metro express line, like Karaj connection, in parallel of train lines. In our opinion, using the capacity of the existing rail is better than a completely new development. A lack of coordination between stockholders in the transport sector, for example Tehran metro company as municipality member and railroad development of Iran as transport and housing ministry members, always create the parallel developments. The investment in the construction of inter- and intra-urban highways is the principal reason for the fragmentation in the Tehran metropolitan area.

- **As a spatial example**: the highway as no traversable boundary cut neighborhoods in two, which results the lack in identity, continuity and infrastructure in the neighborhood.
- **As a social example**: the highway development is merely servicing those people who have access to the car. Highway development models result the fragments between different social classes in terms of access to facilities and jobs. In versus the public transportation development result the decrease in social fragmentation.

The government has launched the construction of the new city, rather than investing in an urban renewal project in central Tehran that offers quality housing to new inhabitants of the metropolitan area. The new cities are developed but the rail transport network, which should connect the new city to the metropolis, just had stayed in paper. The satellite cities of the capital are attracting increasing numbers of new inhabitants owing to the accessible price of real estate. Many argue they have choice, but to locate there, if they are to take advantage of the opportunities provided by the capital, for land there is far too costly for them. In the northern districts, the villas and gardens have given way to urban towers with apartments. From the Karbaschi period, the municipality launched the sale of density to earn money in favor of city development. This policy, despite causing problems in the landscape, indirectly launched the urban densification policies. Unfortunately, the densification was not accompanied by any plan regarding public transportation. For this reason, it added to the problems of road traffic as well as air and noise pollution in northern neighborhoods. From 2004, the new airport was set up to resume the country's international air link in south of Tehran. In terms of urban governance, the reforming government established a municipal council law for each city. From 1997 onwards, the inhabitants chose by election the council municipality that would endorse the mayor, who was chosen by the Ministry of the Interior. The government has kept its responsibility of choosing the governor for each city.

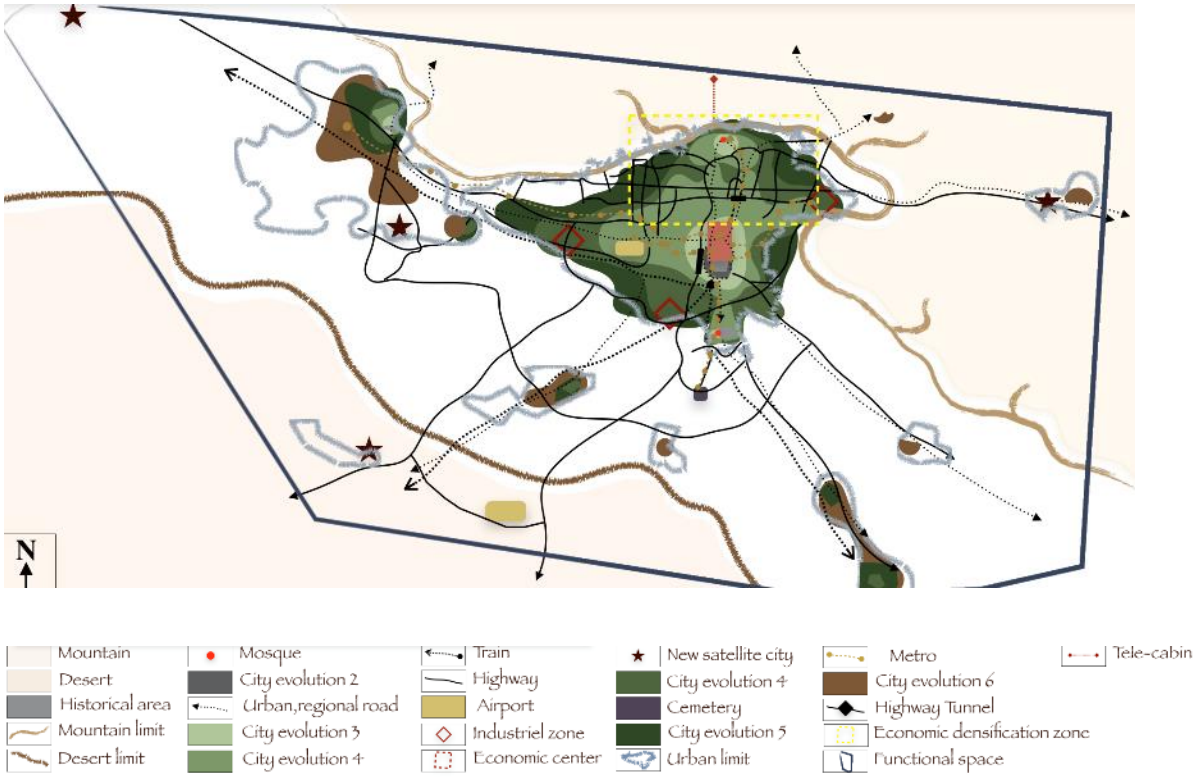

Figure 16: The Region of Tehran until 2010 Source: Alireza Hashemi Behramani, 2017

In 2006, the new master plan was established, proposing the realization of big infrastructure projects, in particular, in the city of Tehran. It envisaged the city of Tehran with an area of about 800 km2 as a polycentric city, with a strong and attractive city center. This was the first plan that was prepared with the cooperation of the municipality and its acceptance meant that it was widely seen as a guide for the future city of Tehran. Today, Tehran has become a metropolis of 12 million people: one of the 20 largest municipalities in the world in terms of size and population. This change of scale is the result of urban planning intention and a consequence of the geopolitical context. Unfortunately, the rail transport infrastructure development has not kept pace with the city's population explosion. Another feature to highlight is Tehran has a large size compared to other cities of similar population. The great expansion of the metropolitan area with the city nearly 100 km across is shown in the figure below, where it is compared to other cities using the same scale.

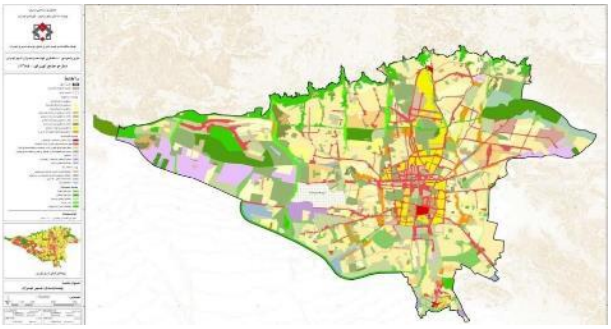

Figure 17: The last master plan
Source: Master plan, 2008

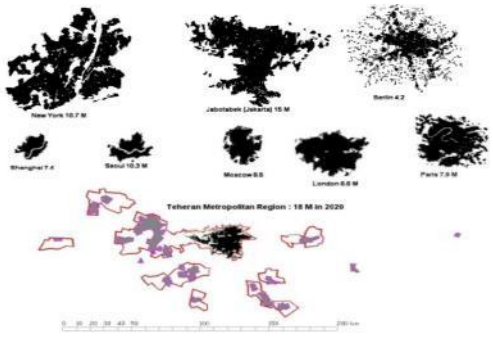

Figure 18: the comparison of the metropolitan area
Source: feasibility study of Alborz Tunnel, 2015

Despite the progress made in the development of the metro network in the city of Tehran, the network remains very underdeveloped in view of the immensity of the city. The reason for this slow growth, as continuously declared by the municipality, is lack of financial resources. When we analyzed the financial resource distribution, we found that the metro project has been awarded

no priority over other projects in the city. Moreover, we concluded that politicization and clientelism have increasingly become obstacles to the metro development. It must be said that the municipality, instead of investing in public transport, has always focused its attention on the development of infrastructure for individual motorized transport. The justification for this claim can be found in the declaration of the mayor of Tehran at the end of 2016, concerning the municipality's success in completing the highway networks according to the road transport plan. The highway tunnel and the highway in 2 floors entered in Tehran Road system from 2005. The construction of the two-level highway in Tehran became a symbol of politicization in the history of urban development in Tehran. Mohsen Hashemi Bahramani, representing the municipal council, said that "with the financing of a two-level highway, the city can finance a north-south metro line in the capital" [20]. Tehran has become symbolic as a city of individual mobility with more than 30 highways with a length of 500 km and the number of daily trips is an impressive 12 million. The population on the outskirts of the city is growing with incredible speed. Migrants who come from other provinces of Iran begins gravitate initially to the new dormitory towns and cities, which are accessible by road and sometimes highways. However, the new inhabitants of these places are suffering from a social and spatial fragmentation that was imposed by the government. To tackle these problems, the latest government has set out to control the price of housing and also providing housing for the underprivileged through a program called Maskan Mehr, which has led to some improvement. In terms of population capacity, drawing the number of apartments under construction, it would appear that each new city can receive more than one million habitants. Whilst a significant amount of investment has been made by the government on building housing, it has not put money into improving the road and rail infrastructure, services and leisure offerings.

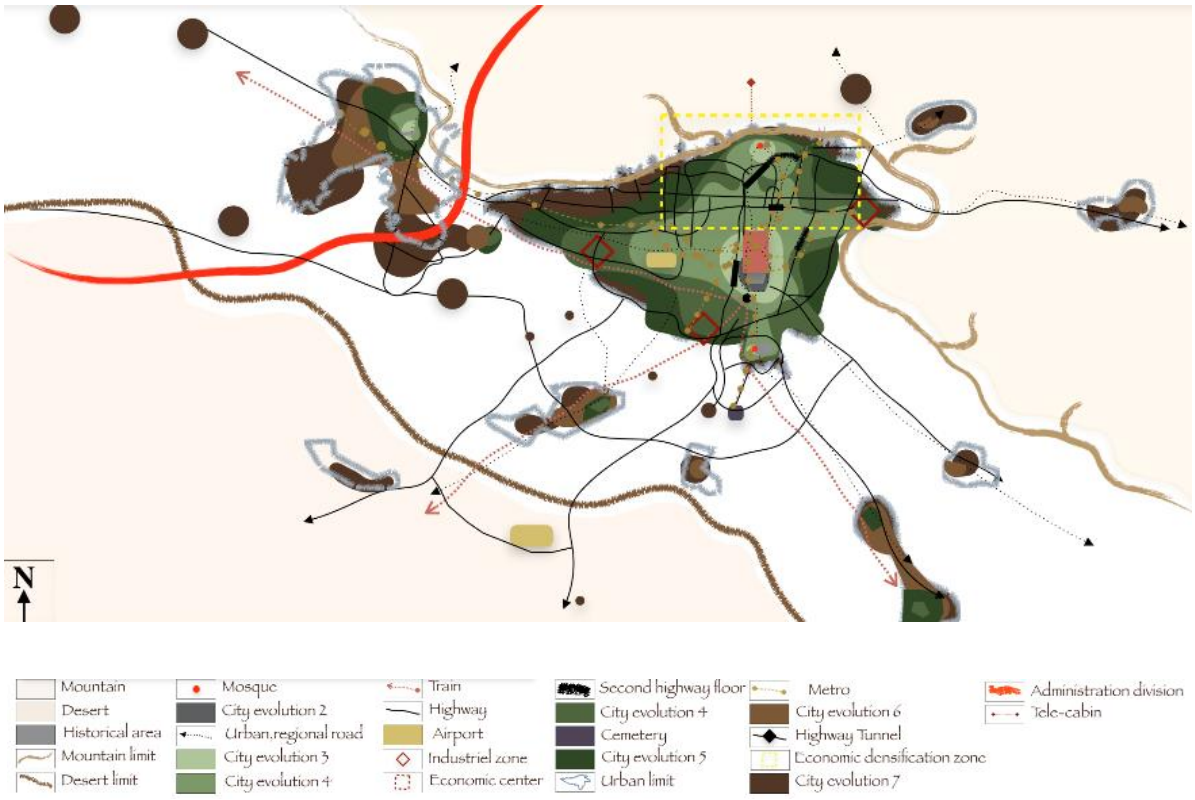

Figure 19: The Region of Tehran until 2020
Source: Alireza Hashemi Behramani, 2017

The proportion of transport cost in the family budget for suburban lower- and middle-class habitants is high. In sum, the development model followed has intensified the social and spatial fragmentation. The distance between the city of Tehran and Karaj is decreasing due to urban sprawl. The government improved the Karaj-Tehran connection by constructing a new highway and also adding a lane to the existing. As a result, the population of Karaj reached the threshold

needed to become a new province according to existing regulations. Despite the mass daily mobility between Karaj and Tehran and the short distance between the two cities, the government created the province of Alborz. Following this change in the system of the city at the national level, the metropolitan territory of Tehran is now divided into two parts, which is complicating the governance of the metropolitan area of Tehran. Normally, in developed countries, the decision-maker tries to adapt the institutional boundary to functional limits in order to improve services to the inhabitant and thus, facilitate cooperation and coordination at the administrative level. But in the case of Tehran this is not the arrangement. It must be added that today we are hearing the demand for the creation of the new province of Varamin by dividing the territory of the province of Tehran further. From 2010, the village and the cities in the mountains linked to Tehran by good road infrastructure, like Lavssan, have accepted the phenomenon of gentrification, with the upper class living in the north of Tehran striving to profit from the better climate.

With the change of government in 2014, the Ministry of Urbanism presented the new strategy for urban development. He declared that "from the year 2017 Transit-Oriented-Development (TOD) will become the development guide of the city" (2017, TOD Conference, Tehran). In response to this strategy the railway company began to provide a daily service to the inhabitants of the suburbs in south of Tehran.

3. CONCLUSION

Our research has shown Tehran as a city that has always had plans and programs for its development. However, due to political and economic issues that have influenced the capital, the city has failed to fulfill its master plans. Instead, the real-estate developers and the political powers that be, who have financial and political advantages, together have allowed for the sprawled development of Tehran.

The main reason for this poor development in the political aspect of the Tehran Municipality. Regarding which, from the 1990s until today, the lack of a stable income for the municipality resulted the sale of density. This policy was possibly due to the legal payment necessary to change the master plan. As a result, the north of Tehran has seen a significant increase in density due to climate attractiveness a real estate value added. The villas in the north have been replaced by futuristic towers. At the same time, the urban density of central areas has decreased owing to people wanting to leave the aging the urban fabric, whilst the suburban areas have attracted the lower classes.

Tehran has been transformed into a metropolis. The real infrastructure has developed since 1960, when the city started to become a metropolis, with the construction of large hotels, hospitals, banks and many administrative and commercial centers. Today, it is a modern metropolis that will reach 20 million inhabitants in 2030, composed of towers and luxury residences. Generally, it is a popular city with an urban fabric dense and vernacular, surrounded by outskirts and satellite towns.

Tehran’s development model, instead of being based on transit-oriented development (TOD) has been taking the form of transit-adjacent development (TAD). In terms of the transportation system, the priority has always been given to private motorized instead of public transportation. For this reason, Teheran has always had traffic congestion problems and today it suffers from bad air pollution. The future Tehran metropolitan area needs to change the focus of transport policies and TOD should become principal strategy for development. Also, Tehran citizens need to change the habit of transportation that relies on an individual transport model. For that reason, paying attention to developing the cultural policies that can change the lifestyle is necessary for Teheran metropolitan areas. Finally, there needs to be effective coordinated urban governance across the metropolitan area if there is to be successful development in the future.

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UNDERSTANDING THE IMPACT OF THE RIVER IN THE REHABILITATION OF URBAN IDENTITY OF GANJA CITY

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ABSTRACT

Throughout its historical trajectory, the city of Ganja has been an axis in shaping Azerbaijan's socio-cultural and architectural landscape. This urban centre not only served as a crucial landmark for architectural heritage but also acquired considerable influence over adjacent regions and neighbouring territories. Notably, Ganja emerged as the nucleus of the renowned Aran architectural school, symbolising its pivotal role in architectural discourse. The Ganja River, etymologically intertwined with the city's identity, intricately bisects its urban fabric, underscoring its geographical and cultural significance. Over epochs, despite shifts in urban centrality, Ganja has maintained an enduring nexus with its riverside periphery. A defining characteristic of Ganja's architectural vernacular lies in its adroit utilisation of locally available resources, represents a harmonious synthesis of indigenous materials and artistic craftsmanship.

Furthermore, the river also exerted influence on the city's structure and performed as a primary supplier of local building materials. These distinctive features contributed to the unique architectural character of Ganja and its surrounding regions. The city and its conurbations endured numerous upheavals, including raids from hostile forces, battles, and catastrophic city-wide destruction resulting from geological phenomenon. Despite these challenging periods in the city's development, it served a pivotal role in safeguarding Azerbaijan's regions and remained a hub of artistic and cultural development.

However, no engineering procedures are undertaken to restore the riverbed and its terraces. For decades, the surrounding environment of the river's banks has remained in a state of disrepair. Its resources are underutilised both territorially and materially. The formation of the riverbed is neglected.

This article aims at re-establishing an understanding of the significance of the river and its resources in shaping the identity of Ganja City. Employing a visual survey analysis and a compiled questionnaire addressing issues pertaining to the river and its environment, a series of recommendations have been formulated for the development of subsequent project proposals. These requirements are oriented towards the manifestation of urban identity and the preservation of architectural heritage within the urban milieu. In line with these objectives, recommendations are provided for the systematic development of public spaces, the enhancement of aesthetic appeal in the central district of the city, the creation of pedestrian-friendly environments, and the revitalisation of small-scale production sites utilising local construction materials derived from natural resources.

Keywords: *inclusiveness, urban identification, river rehabilitation, local materials, aesthetic, public space, Ganja*

1. INTRODUCTION

The river is one of the elements of the city-forming structure that naturally becomes the embryo of the city's development and its civilisation. The river serves as a fundamental component in shaping the structure of a city, naturally river evolving into a central element influencing the city's growth and civilization. Ganja River has been integral to the cultural heritage, serving, for instance, as a material source of the regional identity. The has played a crucial role in the existence of Ganja City. The city was executed as the first capital of Azerbaijan in the past and currently stands as the second-largest city.[1] The Ganja River has been a valuable resource for the local community, providing essential construction materials. Ganja City played the role of an urban hub, hosting various cultural and religious events, and

embodying the region's identity and symbolism for centuries. To foster the growth of a city, it must develop a structural framework capable of adapting to both basic natural features and social capacities.

The master plan of the Ganja riverside area has the potential as a city public space that will linearly contribute to improving the quality of life of the community economically and socially, in addition to being able to maintain environmental sustainability.

Historically, due to its geographical location and favourable conditions for settlement, the city of Ganja evolved into a cultural and commercial centre, exerting regional influence that extended beyond the borders of Azerbaijan. Throughout its sustainable tradition, Ganja City has consistently served as a valuable asset to the local civilisation, characterised by its diverse economic resources, an overlap point for various cultures and ethnicities, and symbolising the broader regional identity.

The placement of the Ganja riverside has the potential to function as a linear public space, thereby positively impacting the economic and social well-being of the community. Furthermore, this location potentially has the capacity to uphold environmental sustainability. Using all the potential of the central location of riversides the design is directed toward to improving the city's identity, and social impact and will essentially allow for improved pedestrian accessibility, mobility, place attractiveness, and human health being. Lynch (1960) suggests the imageability of the city and legibility of the physical context to be preconditions of the visual quality of the city environments. Enhancing the city's identity arise new economic activities for local citizens. The design approaches on urban riverfront zones are standing by to pursue an outstanding influence on both mobility and human endeavours, facilitated by the strategic organisation of public spaces, enhanced access, and the offer of public convenience. The Ganja riverfront is physically constituted by certain territories and infrastructural components, including a partial boulevard line, lower dwellings, a post-floating area, and commercial buildings.

Assessing the Ganja riverside zone from a sustainable perspective, its organisation is capable of preserving the area by restoring and rehabilitating it, thereby enhancing the identity and function of the districts. The Ganja riverfront area master plan has the potential to develop into a city public space that fosters cultural and recreational pursuits while also generating economic benefits by encouraging the growth of the local art industry.

The riverside in terms of urban structure is connected to the surrounding fabric and has a rich heritage, particularly as part of the city centre. By integrating its natural and cultural prospects, the Ganja riverfront territory demonstrates the properties of being a popular leisure and tourism destination. Urban waterfronts have always attracted developers because these places pose a variety of opportunities for tourism, economic, and community development.[2] Urban design of a sustainable riverside area must provide the interrelation between the river as a central line on the city structure and the entity of urban districts. Rivers are one of the most important natural resources, and the close connection between cities and water is an integral part of the history of our civilisation.[3]

Despite the primary focus remaining on future development, planning and development of coastal territories primarily implies strategic advantages in cultural and historical significance. Planning for optimal development of waterfront areas supposes the rational integration of contemporary development principles with the cohesive natural environment land use. This symbiotic blend acts as a critical determinant in fostering sustainable development, including the complex ties between urban planning, economic study, and geographical factors in accordance with the research realm.

This paper aims to develop strategic recommendations for the development of the riverside master plan as a city public space that serves an image of urban identity while maintaining well-being and environmental sustainability. Design practitioners need an evidence-based theoretical framework to inform decision-makers to process and address the complex issues related to environmental responsibilities and well-being.[4] The area in the city possesses the potential to contain a balance of continual urban growth and regenerative part.[5] The methods of analyses directed to reveal the significance of urban identity and inclusive environment performs an essential part in regional planning strategies. The conceptual framework for riverbank development includes the structure of green space, encouraging integration between the river and urban setting, determining interaction zones, and including a variety of public activities. This paradigm emphasises the significance of intentional design in urban growth, especially in the fields of urban planning, economics, and geography.

2. MATERIALS AND APPROACH

Ganja was chosen as the research subject due to its history, and regional significance as a thriving economic and cultural hub, alongside its notable development in architectural heritage and urban planning. The river's central location within the city's structure serves as the focal point from which urban features of development are extended.

However, the current statement of Ganja's riverbanks leaves too much to be desired. Issues concerning the riverbed's condition have been neglected for decades, resulting in a lack of control over water flow during flood or ebb tide periods. Consequently, several instances of flooding affecting residential areas have occurred in recent times. The selection from several newspaper illustrations below the reports on some flooding disasters. (Figure 2.) The extensive flooding leaves no opportunity for development along the shoreline. An entire zone of private residences next to the first area of research territory has been lost. Additionally, river stone materials are not incorporated into the urban landscape. The city of Ganja lacks adequate infrastructure for residents and builders to access a wide range of local stone materials. As a consequence, there is a gradual disappearance of regional materials from the contemporary architectural heritage of Ganja.

The research has not delved into the detailed measurements of the affected area, because the scale of the problem regarding the disconnect between past and present architectural features was obviously apparent during field observations. This article is intended to change the understanding of the city's governing elite, restorers, builders, architects, and stakeholders involved in the development of Ganja and its regions. As part of our proof foundation, the authors conducted several visual inspections of the area, gathered data, surveyed the local situation, and analysed press coverage and scholarly literature. Based on the survey of the area this article, provides a series of observations, highlights risks in future development, offers recommendations, and, as part of the research, presents a strategic planning recommendation for the riverside area of the city centre.

3. STUDY OF SITES

3.1 Survey system

The surveys on local people's opinions were conducted on the base of face-to-face questionnaires. Short interviews to receive their unbiased thoughts have been taken on different days but in good weather conditions. Our questions combined the groups and divisions to collect the opinions of citizens about the attractiveness of space along the river coastline areas, mixed use of its resources, accessibility to the coastline and its inclusiveness to the city structure and aesthetic, as well as rehabilitation of urban identification in Ganja City. The questionnaire has five groups and their results are presented in Tab.1. The survey was based on a ten-point Likert

method and all responders answered according to the scale from 1 to 10. One is representing "negative impact". Ten represents "positive impact". Five is the middle "neutral". The total sum of valid responses comprised 126 participants. The interviews were conducted in May 2022. To receive reasonable opinions from respondents the survey has been followed with a short talk regarding the opportunities in terms of design, urban heritage and environment build. The Ganja river passes through the geographical centre of the City. Due to territorial heterogeneity and diversity in the environmental stage, the research site of the river coastline and connected territory was zoned by 3 areas. Figure 1.

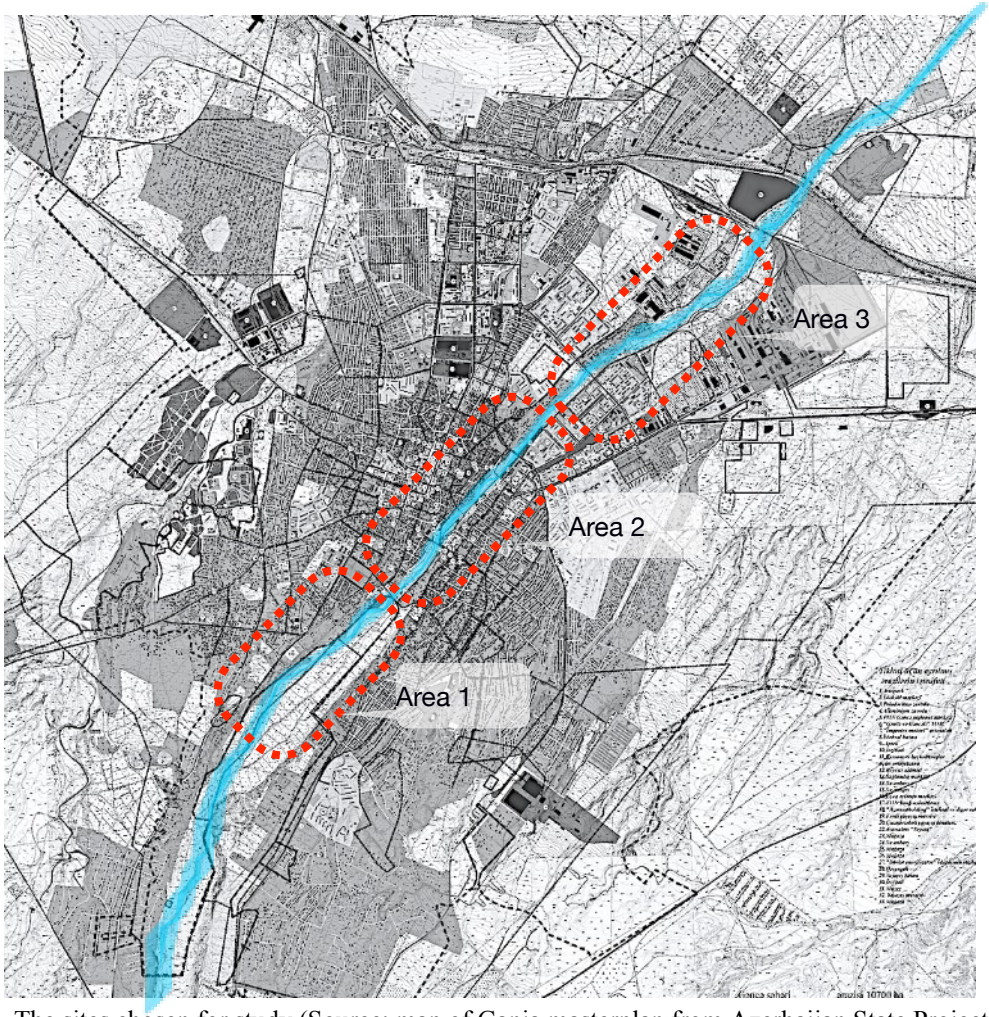


Figure 1. The sites chosen for study (Source: map of Ganja masterplan from Azerbaijan State Project Institute)

In each area, the passing visitors were randomly met for short interviews. The social demographic information is shown in Tab.1. Generally, areas 1 and 3 are imbalanced because of either their spatial entity or connection to the central zone of the city. The first area covers the periphery partly developed in the post-soviet decades, exposed by commercialisation irregular planning. The second area was mostly extended in the Soviet period. Nowadays, the area is active for certain public activities, supporting holiday events, and providing some daily active public space.

Meantime the middle zone of the coastline comprises an inactive section that is out of comfortable or preferable space for a public of all ages. This area contains the boulevard and local public places. The third area is disposed of near historical ruins of the old antic period. It was the first location of the city. Also, the third area includes the connections to the urban fabric. Potentially, there are some housing districts attached to the coastline. At the same time, this place has undergone waterlogging. The disaster was covered by many local media channels. Figure 2. Previously, the authority has implemented several attempts to renovate the area of the

river coastal site, yet it needs to assess the results of complete reconstruction and to be aware of people's perceptions and suggested visions.

3.2 Groups of data collection

Among the three groups of data collection, the first gathered general information on gender, age, education level, work, and monthly income to gain social and demographic status. Tab.1. Then in Figure 3, in the first group of survey data, the information was collected on the "cause of visit" and purpose of recent coming.

Figure 2. The collage of diverse articles which illustrated the consequences of flooding and the formation of garbage dumps. Source: Google search

The second group is focused on the "visitor perception" of visual, and emotional attractiveness. Meantime they were asked to assess the positive and negative impacts of the overall surrounding stage of landscape, public facilities, and their stage of well-being, some of the options were specified as supplemental by the respondents. The third one, is the input regarding the needs and vision of people on the intended service of places. In this section, they were asked about the lack of quality of life. At the same time, there were proposed various opportunities arising from the river to arrange planning for better environmental condition on the coastline. That group of data has been assessed to evaluate possible factors for consideration in the decision process for such a proposal: particularly in the planning, and design of river rehabilitation projects. Based on the total responses received from participants, most respondents (33.3%) in the central area were middle-aged (35-55), while respondents in the first area were dominated (13.5%) by those over 55 years old. Therefore, compared with respondents in the second and third areas, the majority of visitors from the first areas were older and retired. However, they had tertiary education.

Besides, the third area comprised less of respondents, due to its territorial abandonment in the north-east city's periphery, where the interviewees were divided between middle-aged and young. Hence, this group of data was more unbalanced than others. Remarkably in that area, there were some teenagers seeking the appropriate place to play football. Regarding the occupation total for all three areas, the employed were 50% with monthly income over 700 - 1000 AZN. The majority of retired people in the first survey area were mainly due to the city's region which entity was more suburban. In terms of visiting reasons to the areas, the second one hosted a higher amount of pedestrians who came to walk and for leisure or trips of "passing by". The influence of ties with the city centre explains daily passing in this area. Furthermore, the attractiveness of this place affects other purposes just to pass by. A short meeting with citizens meant asking about the visual attraction of the area to evaluate visual effects of the environmental setup, space ambience and "sense of place".

Comparing the areas, it appears that visitors were more satisfied with the places situated near the urban heritage, urban centre, and public space. More conversely, for the third area, they have literally disagreed with abandoned views of the surrounding space of ruins (Ganja's ancient site). Consistently, citizens were revealing the lack of city heritage reflected by the disappearance of the entire range of local materials and, the acquisition of access to river nature sites.

Table 1. Groups of face to face survey

Groups	Division
1 Social	education level, employment, monthly income
2 Demografics	gender, age
3 Visiting reason	sport, passing by, rest walking, other pastime, regular visit, observing of landscape
4 Perception on places	urban identity, attractiveness, visual impact, fresh air, noise, accessibility, public activity, emotional effect
5 Citizen visions	table and bench, art exhibit, lawns and trees, historical places, playground, bike lanes, walkways, jogging trails, use of river stones, terraces to shore

Social, demographic data of participants in %

Groups	Categories	Area 1	Area 2	Area 3	Group	Categories	Area 1	Area 2	Area 3
Age	< 18	4	9.5	3.2	Educational level	primery school	5.6	8.2	-
	18-35	6.3	13.5	-		secondary school	6.3	8.6	4
	35-55	1.6	33.3	2.4		institution above	13.5	52.2	1.6
	> 55	13.5	12.7	-	Occupation	employed	8.5	39.7	2.4
Gender	male	17.5	42.9	4		not working	5.3	12.5	3.2
	female	7.9	26.1	1.6		retired	11.6	16.8	-
Monthly income	< 500	15.5	10.5	2.6					
	500-1000	7.7	38.3	3					
	> 1000	2.2	20.2	-					

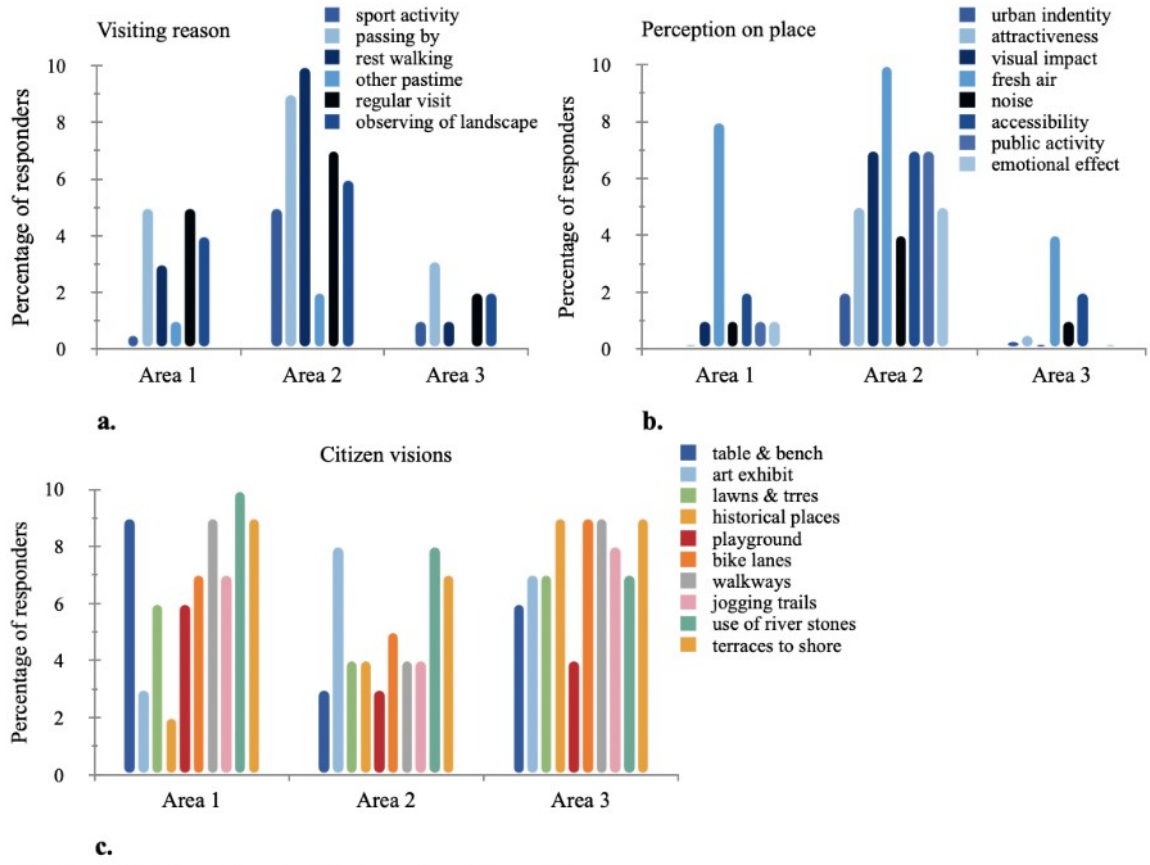


Fig. 3. **a.** Visiting pattern, **b.** Site impact, **c.** Citizen vision

Overall, based on the authors own visiting experiences to these sites, they believe that the survey results realistically capture the perceptions of the majority of the visitors. The overall experiences on visual attractiveness, amount of public space, and environment cohesion with the build are more negative at the sites due to an alienation of coastline from the historic city, partly

in the middle of the surveyed territory but particularly in neighbouring areas. Ganja is an entirely historical city, indeed concentrated in its geographical centre. The urban structure generally relies on coastal line. On account of local potential, the coastal line dominantly comprises most of the urban arteries and likewise the access to the parts of urban heritage.

4. AESTHETIC VALUE OF ANCIENT GANJA

Historically, Ganja has been a city characterised by a diverse population of various ethnicities and cultures. During ancient and medieval times, as a result of the influence of the Silk Road, numerous representatives of different peoples traded and resided in the city. Primarily, they hailed from the East. On the other side, later on, certain architects from Europe worked in Ganja. Today, multicultural heritage framed in an urban context can play a fundamental role in enhancing city identity and in providing a stable platform for social and economic renovation. Sustainable development seeks to protect and improve the cultural heritage while comprehensively considering its cultural, geographical, and social aspects.[6]

While visiting this remarkable city, architects may often distinguish the aesthetic in the traditional buildings of old Ganja and how their historical identity is remarked thanks to the presence of local materials. Lynch (1981), the identity is the extent to which a person can recognise or recall a place as being distinct from other places by having a vivid unique or at least a character of its own.[7] Ganja city is a place which keeps a diversity of regional identity. The construction of old buildings covers different historical epochs, alongside the craftsmanship of diverse ethnic and religious groups, vividly illustrates the underlying essence of urban identity inherited from preceding generations. A visual analysis of Ganja's architectural environment reveals richness in both inherent details and architectural style, representing each historical period. An architectural work is not experienced as a series of isolated images. It fully integrates the local materials to provide the embodied spiritual essence of a historical place.[8]

As a result of the economic connections actively traversing the Silk Road, migrated population from different corners of the largest continent have, somehow, utilised local materials. River stone is widely applied in masonry, which is visible in the ruins of the city, attributed to ancient times.[9] The masonry of large boulders and clay backfill is clearly visible on the fragments of the ruins of the old town. Local clay with a reddish colour was used as a binding filler. River stones are included in the foundation masonry as the main structural material. Figure 4.

Figure 4. Variants of Ganja's masonry (Source: book, "Ganja: Architectural Chronicle 12th-19th centuries") [9]

It is worth noting the gradual evolution of construction technology over centuries, leading to the emergence of new stylistic trends. Yet, amidst these changes, the landmarks of the city from that era exhibit a remarkable continuity in tradition, showcasing the distinct characteristics of the local architectural school. Observing the aesthetics of buildings such as the Juma Mosque, State Puppet Theatre, and others (Figure 5), it particularly discerns the rich architectural palette used to convey the attributes of their respective ethnicities while correspondingly and harmoniously merging them into the broader context of Ganja's urban heritage. Indeed, in many places of the world, a predominant idea of heritage has been limited to consider only the historical monuments

that represent the artistic achievement of a city. The traditional view of heritage has gradually changed since the 1960s, both in the normative domain and in the public perception.[10]

a. **b.** **c.**

d. **e.** **f.**

Figure 5. Views of the aesthetic context of urban heritage of Ganja city
a. - Juma mosque, **b.** - State Puppet Theatre, **c.** - Old Turkish bath "Chokek", **d.** - Administrative building, **e.** - Turkish bath, **f.** - Old residential house

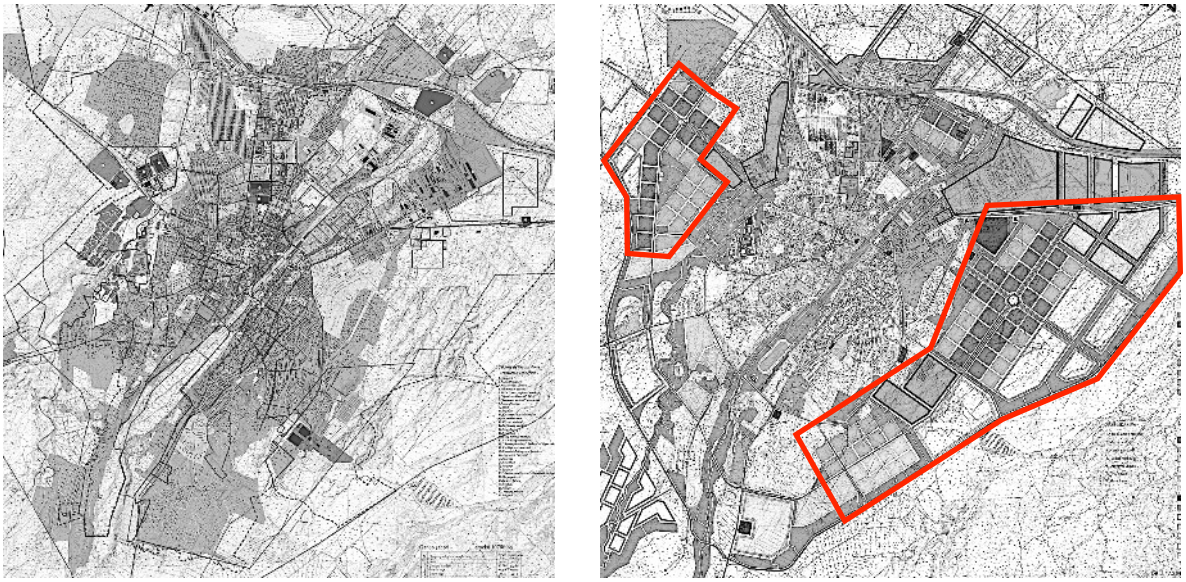
Each building representing the ancient period of Ganja is designed individually. However, there is a common manner and harmony in the rhythm of the facades. Adhering to the principles of a broad range of solutions, architects of past centuries created a unique spatial scene of urban heritage. The preliminary distinctive element of traditional architecture in Ganja City is the utilisation of traditional local materials. The specific features of the Aran architectural school are contrasted with the multidimensional, architectural traditions: in the grandeur of sculptural forms, their spatial organisation, and mature technical skills. The artisans of that era endowed the city with a characterful heritage and a sturdy foundation of a harmonious urban environment. Consequently, they pass the regional heritage to future generations.

5. DERIVATIVES OF IRREGULARITY IN URBAN SCALE

5.1. Irregular aesthetic and visual order in an urban environment

Over the last decades, Ganja has undergone rapid development and construction of housing and commercial real estate. At the same time, similar to most other cities, this urban centre grapples with the inadequacy of legal approach to preserve its aesthetic identity. In fact, the dominant trend regarding the pace and character of construction, as well as the architectural style, originates from Baku, the capital city. One of the prevailing ideas among developers in every city is to attract and accommodate a larger number of tourists. The development primarily focuses on the construction of hotels, restaurants, shops, and residential apartment buildings. Baku serves as a benchmark for these trends and influences construction patterns in other cities. The authors conducted multiple field surveys in Ganja and noted a prevalence of residential construction in the city. The most recent urban master plan for Ganja dates back to 2012. Within this plan, extensive areas were designated for the expansion of residential districts. Figure 6.[11]

Previously, in Ganja City, the residential area per citizen was 13.9 m2. It was planned to increase this indicator to 15.5 m2 by 2015, for which 1,990,000m2 of new residential buildings were intended to be built, and between 2015 and 2030 another 2,572,000m2 of the residential area was programmed to put into operation.[12]



a. **b.**

Figure 6. Masterplan of Ganja City, **a.** Existing situation plan, **b.** Proposal plan and are of residential development. The author's illustration elaborated on the base of masterplans from the source of the "Azerdovletlayihe" - State Project Institute.

Nonetheless, in the years before the approval of the master plan, high-rise residential buildings were constructed in close proximity to historical buildings (2-3 storeys). These relatively new buildings, in terms of style, do not reflect associations with the traditional architecture of the city, neither in propositional composition nor in materials selection. Numerous examples of this essence return to the dominant direction of typical construction in historical Ganja.

5.2. Ties of interest in the construction realm

Observations of the outcomes of new construction in the city of Ganja have also revealed the widespread utilisation of limestone. This material serves as both a primary building and a facing resource. Limestone is quarried and processed in other cities, being a distinctive building material for the Absheron region and the capital city of Baku. For instance, in the XII century, limestone was the primary building material in Absheron, offering significant decorative potential, which was skillfully used by craftsmen. In this region, limestone, locally referred to as "cube stone," stands as a natural resource. Consequently, the trends of the capital city, Baku, not only dictate stylistic preferences but also the material arrangement of today's projects in Ganja. Even regarding the completed fences of private houses, which were not tall before the Soviet era, it is evident that they have acquired a new section executed in a non-local material. Additionally, the trend towards high fences indicates a bias for people to isolate themselves, becoming less socially active and more reclusive. As a result, the aesthetic of Ganja's residential quarters loses its uniqueness, shifting into an environment of unattractive streets like the corridors surrounded by high fences.

The visual examination also demonstrated the extensive usage of materials traditionally not associated with local architecture. Metallic roofs of private houses painted in various colours are inserted in the historical area, while facades feature limestone additions that do not match the typical bricks and river stones style of the surrounding architecture. The majority of buildings constructed in the last decades have incorporated limestone, used as structure and facade's cladding materials.

There are no shops of brick industry in the city where bricklaying artisans would work. Although regionally Ganja City possesses the natural earth resources for manufacturing of bricks and river stones of diverse fractions. It is worth mentioning that in the past, mixed techniques involving river stone were used alongside brick buildings.[13] The application of river stone, characterised by its natural appearance, contrasted with bricklaying. Thoroughly specified proportions and the workmanship of Ganja's architects imparted a typical character and style to the local architectural tradition. Thus, the city of Ganja acquired the deep roots of traditions in construction and architecture.

5.3. Remnants of post-soviet time and the reasons behind the mitigation of urban aesthetic

Notwithstanding the changes in the economy, urban planning, and society over the years, the prevailing regulations largely retain the rules and design norms established during the Soviet period. These regulations persisted for extended periods without modifications or updates. During the Soviet time, many cities had an outstanding similarity to one another, and the Soviet authority pointed little interest in supporting the urban identity.[14] Public spaces were planned within city layouts without consideration for their cost-effectiveness or functional utility.

As Kessides (2000) argued, the organisation of post-socialist urban areas often lacked consideration for commerce or market dynamics. Adapting these areas to market efficiency principles has necessitated significant changes in how urban activities are particularly arranged. [15] There often built the massive nondescript or regular residential buildings too close to heritage architectural complexes, failing to create compositional accents that complemented to the area of historical architecture. During an era of prohibitions and widespread austerity, the city lost its individual essence. Meanwhile, at the level of master planning, in Soviet cities, certain strategic decisions were implemented for the prospective future of city and social development. Thus, the main squares, boulevard zones, etc., have reached our days.

Despite the certain beneficial uploads on urban center, the city has not been able to avoid issues that met from decades of post-soviet redevelopment. As in many other cities, these problems included a retreat from planning; lack of institutional coordination; poor implementation of laws; chaotic development patterns; irregular suburban sprawl and a surge in informal construction. Moreover, the impact of transformation was felt in the loss of open space in urban areas, the privatization of the public realm and social stratification.[16]

Nowadays, visiting the entire Ganja city centre there is a visible discord around the two-three storeyed ancient buildings and a giant 10-12 storeyed residential building nearby. Due to these reasons and regulations unresponsive to the demand of the place market, the urban fabric met unequal density and gradual loss of aesthetics on a city scale.

As noted by Bertolini et al. (2005) in order to be useful for practical planning purposes, an accessibility measure must meet two basic requirements: it must be consistent with the uses and perceptions of the residents, workers and visitors of an area, and it must be understandable to those taking part in the plan-making process.[17] In soviet time most of the decisions in urban planning were taken without people's participation. Through the past years, that approach imparts the formation of very weak activity of habitats and non-functioning local communities in terms of institutions which able to raise adequate opinion and participate in the urban project.

5.4. Dispersed accessibility of suburban structure.

Across its history, the city of Ganja has endured numerous upheavals, ranging from medieval confrontations against invaders, earthquakes, shifts in economic city profile after the Soviet time, and issues of post-Soviet redevelopment. In 1139, an assertive earthquake struck, causing extensive destruction to the city. Consequently, a decision was made to relocate the city and commence construction in a new place, along the river. Following the city's relocation, the river once again crossed the central part of the city.[18]

During medieval periods, the river not only physically divided the city but also served as a religious split. Primarily on the left bank, where the fortress and Juma Mosque were situated, Muslims resided, while newcomers inhabited the right bank.[19] Over the centuries, the Ganja

River played a pivotal role in the structural division of the urban fabric. The main paths and roads of the urban structure traversed the river. Additionally, at the district level, primary pedestrian zones extended along the river, gravitating towards the coastline that integrated both sides of the city.

Since the Soviet years, the urban structure has undergone significant changes. Attention was directed towards major avenues, public squares, and boulevards when developing the master plans of that period. Nevertheless, a distinctive feature of that time is the widespread replication of Soviet-era nine and five-story standardized residential blocks. Each epoch has left its historical heritage and approaches to city development. The practices of past decades have endowed Ganja with the potential to be a modern city. The modern cities face several challenges, including inaccessible public space and unattractive street environment (Cervero et al., 2017) [20], noise, air pollution and health hazards (Bouguerra and Bhar Layeb, 2019) [21], and urban sprawl (Rubiera-Morollon and Garrido-Yserte, 2020)[22]. The accessibility is an important index in measuring the development of the waterfront.[23]

Presently, the city of Ganja boasts a nearly one-kilometer-long boulevard running along the right bank of the river. On the left bank, the boulevard line is intermittently interrupted by various squares and alleys, in total approximately 700 meters. A field survey revealed discrepancies in the issues present in the urban structure along the waterfront. In this article these issues were classified into the types presented in Table2. Most of the identified deficiencies in territorial development relate to the lack of connection, accessible pedestrian spaces along the riverfront.

Table 2. Types of potential zones of territorial and visual issues

Section types	Description of reason or environmental situation
1 Disaster area	The area is periodically inundated as a result of river flooding
2 Areas of irregular formation of vegetation	The territories in the form of self-organized islets and vegetation on landslide soils (sometimes based on disaster-affected areas)
3 Areas of irregular formation of building	Private houses and commercial buildings are constructed dangerously close to the water.
4 Areas inaccessible for pedestrians	There are parts blocked off from road infrastructure
5 Areas closed from the riverbank	The places along the river that lack a view of the natural river landscape
6 Areas of ancient history	Places along the river where the ruins of the old city are located and inaccessible to people (actually, this place is used as construction waste sites)
7 Areas of non-active boulevard part	The area not visited by citizens due to the lack of attractiveness

Jane Jacobs, in her great work “The Death and Life of Great American Cities” [24], was one of the first authors to call attention to the inefficiency of the dispersed city model. Planning of the updates on urban policy is particularly focused on the need to provide proper accessibility in urban structure. Therefore, it is clear that the increase in the shared public space and attractiveness of places accessibility plays a key requirement. Bhat et al. (2000) use the following definition: Accessibility is a measure of the ease of an individual to pursue an activity of a desired type, at a desired location, by a desired mode, and at a desired time.[25] The imperative need for accessibility is particularly evident in the conceptualisation of optimal urban structure functionality, the enhancement of landscaped waterfronts, the organisation of attractive central points within a comfortable environment, and the establishment of new space open to urban heritage sites. In this regard, special attention should be directed towards the third zone as shown in Figure 1, where the ruins of the old city of Ganja are. Currently, this place is abandoned and lacks maintenance.

A general survey of all sections of the waterfront particularly reveals a lack of cohesive planning for land use, as well as limited access to potential recreational areas and public spaces. In fact, this urban area ultimately has the presence of attributes of dispersed accessibility.

6. PROSPECTS OF INCLUSIVE RIVERFRONT

6.1. Reframing the prospect's sources on urban identity

Numerous scholars have delved into the research of a local distinctiveness, aiming to illuminate its identity through a comprehensive examination of tangible and intangible components. Proshansky et al. (1983) articulated that the essence of an identity of the place is an emotive and relational tie that citizens establish with its meaning, thereby manifesting its significance and fostering a sense of belonging among and well-being.[26] Davide Canter et al. in his book "Environmental Social Psychology" assert that "The environment attains its symbolic meaning as a substrate of social, emotional and action-related conceptions primarily through these concrete relations. In our understanding of "urban identity," historic landmarks in urban areas perform a major part in the formation of place identification, shared memories, and a sense of belonging.[27] Moreover, Scheffler et al. contended that cultural heritage is interpreted as a "soft" asset, affording cities a distinctive identity while competing with other urban centers for to attract the international market.[28] In this regard, there is an understanding that the quality of the surrounding environment, including architectural and urban spaces, is bound with the psychological aspects of society, subsequently exerting influence on its culture.

"We shape our dwellings, and afterwards our dwellings shape us."

Winston Churchill

Thus, negative attributes of urban spaces such as inaccessibility, unattractiveness, and abandonment predispose to the degradation of social ties among city residents. Consequently, this leads to a diminished opportunity for inhabitants to gain a broader understanding of their city and its history. Urban accessibility inherently impacts upon urban identity. Heritage plays a crucial role in urban identity as it shapes the city's character, history, and cultural uniqueness. City planners often strive to preserve and incorporate heritage sites into urban landscapes to maintain the city's unique identity.

6.2. Aesthetics that reflects urban identity for centuries

A city is a place associated with spatial signs, architectural symbols, and a special environment. Due to the aesthetics surrounding us, we can accumulate the impressions and memories that after the years can plunge us into the entity of culture of the people, and ambience of valuable urban heritage. Urban identity can be defined as the impression invoked on its inhabitants by the environmental, historical, socio-cultural and spatial values.[29] Therefore, spatial aesthetics that collect associations with the nature of place and environmental elements as a consequence can produce the context passing urban identity to the next generation. Identity that sets it apart from other cities, acquires an aesthetic aspect, which is what makes it unique among cities with varying phases of development.

The aesthetic value of the future cities, in terms of architectural heritage, is reflected by multiple vocabulary, and traditional approaches consists of the holistic view of streets, places of the city. The appropriation of urban heritage is important in the context of the preservation of city assets.[30] Urban planners and modern architects look for ideas and aesthetic standards for these cities that are sustainable in the now and the future. From the perspective of urban sustainable development, any impact of urban activities on the environment must be minimised. In narrow scope: urban design represents the form of human settlements, physical features at scales larger than a single building. It can be done through the manipulation of the concrete elements of distance, material, scale, view, vegetation, land area, water features, road alignment, building style, and numerous other items that create the natural landscape and the built environment.[31] By Sydney H. Williams, the study of aesthetic characteristics of cities must go beyond concern only for the design of some of their parts, such as boulevards, parks and civic centres.[32] In Ganja's historical cityscape, local materials are commonly used in buildings, especially brick. These structures, found across heritage parts of the city, contribute to its distinct identity. Previously, there was a remarkable tendency to use local materials, such as river stones,

for paving as well as for building fences. Historically, the city of Ganja, similar to many other cities in the world, was closely bound to the flow of a river. Ganja's river flows through the centre of the city, dividing it and at the same time serves as a focal point connecting the two sides. In the past, architects and local artisans used natural materials in construction, including bricks and river stones of various sizes. The application of local materials contributes to the aesthetic identity of the city, reflecting Ganja and its construction culture. Today, it is feasible to revitalise and upgrade the production of materials based on local resources. The process of restoring the coastal part of the river will require certainly engineering solutions. This rehabilitation planning is strictly related to the engineering procedure. In this aspect, process-based reconstruction becomes one of the fundamentals in river rehabilitation, supporting the material aesthetic component of the city and creating a favourable construction resource for the local community. Process-based restoration emphasizes the restoration of environments where natural river processes, such as water flow and sediment transport, play a key role in creating a sustainable function of the river ecosystem.[33] Therefore, the rehabilitation of the river is related to the renewal of processes around all its potentials. In fact, the rehabilitation potential has three components of sustainable development, as it positively affects the natural landscape of the area in the specified riparian zones, arrange additional public spaces and pedestrian pathways to bond with heritage sites and economically offers new opportunities for local small businesses. Over the centuries, the Ganja River has played its role in construction, creating a unique aesthetic of regional architecture. The sustainability of Ganja's urban aesthetics is in fact primarily dependent on materials produced from local natural resources.

As of 2023, the coastline has been structurally disconnected from the central part of the city and has an unorganised aesthetic, function and design situation. The character of the urban fabric is dominated by irregular low-rise housing development and disorganised commercial areas. The functional processes taken in surveyed sites specifically correspond to the place of amorphous urban fabric and are accompanied by: spontaneous parking, chaotic advertising, places with the disastrous state of houses after flooding, concrete structures (coastline reinforcement)

a. **b.** **c.** **d.**

Visual environment of corresponding urban fabric zones, Source: Author's photographs

a. **b.** **c.** **d.**

a. - Irregular housing, **b.** - Riverside housing, **c.** - Commercial area, **d.** - High story building,

Figure 7. Morphology of urban fabric around and on the riverside, Source: topography plan, AzDLI

that in some places do not have the ground under them, the use of all sorts of materials that are not typical of the traditional aesthetics of Ganja. Figure 7 illustrates morphological types of urban fabric corresponding to the left and right banks of the river.

The entire coastline passing through the central part of the city, since it is a historical zone, requires a private approach to this area to create a design code. The river can included with its territory, natural material, and ecological resources, if according to sustainable transmission the city administration launches the identity's rehabilitation program to return the Ganja's unique urban aesthetics for the next generations. Sustainability concerns of the living environment reflect the need for solutions in regional and urban planning. Although the SDGs (Sustainable Development Goals) generally reflect ethical values and hold aesthetic potential. SDG # 11 focuses on making cities and human settlements inclusive, safe, resilient and sustainable, where sustainability in urban aesthetics is an important quality criterion.[34] The comprehensive restoration of the river and coastline is expected to improve the quality of life of the citizens of Ganja in a holistic manner.

6.2. Potential of urban inclusiveness in riverfront

In IX-X centuries, urban principles, compositional technic and creative methods which have been used in the building of Barda (cultural and administrative of Arran's region), in the architecture of Shamkir, Beylagan but mostly in rapidly growing Ganja city. (V.V. Bartold)[35] There were many of the greatest masters in architecture, poetry and music.

In the Medieval period, Ganja was not only a repository treasury of regional architectural schools. For centuries Ganja has been gaining the image of a city that trends the local and regional urban planning styles. This city has a valuable potential for unforgettable architectural thought.[36] The city, according to Italian architect Aldo Rossi, embodies "the repository of shared memory," accumulating the historical layers of human activity. (Rossi, 1966) It serves as a vibrant, evolving landscape shaped by its past, influencing not just the present moment but also shaping future trajectories.

Table 3. Recommendation towards rehabilitation of the inclusivity of river in urban identity

	Zone of rehabilitation	Description of recommendations
1	Use of natural sources of materials	Areas of periodic flooding require a comprehensive solution for engineering reinforcement of the riverbank using local natural materials
2	Landscaping as coastline reinforcement	Environmental planning of the territory considering the reinforcement of the coastline by terracing and planting of riverbank reinforcing plants
3	Rethink of land use in order to develop walkable areas	Program of gradual transformation of the functional zoning of the territory with irregular buildings and buildings constructed contrary to the historical context of the city in order to increase the ties with public spaces
4	Planning of cycling system of sidewalks and bike lanes	Design of a cohesive system alongside the coastline as well as pedestrian spaces
5	Transit-oriented places to view on river landscape	Building open spaces with opportunities for panoramic views of the river landscape
6	Open attraction of historical ruins	Upgrading and inclusion of historical zones in the tourist's travel map of riverbank
7	Activity mapping and authentic centres	Development of a multi-zonal activities structure on the boulevard and organization of attraction points with a focus on the promotion of an authentic image of the city of Ganja

Therefore, in Ganja city, what is being built in our time continues to acquire the ties of participation in a dynamic process of the growth of urban heritage, which in a changed stage comes to the next generation. It was visually observed that nowadays the aesthetic attributes of the new buildings are abstracted from the space and unrelated to the urban heritage. The numerous of aesthetic dissonance among urban fabric takes on critical mass and has a negative potential to destroy urban identity. It is currently worth to establish pathways in urban planning to all of the city's heritage landmarks. The location of the river in strategic terms to create pedestrian links and passages to the city's heritage is essential. Inclusive prosperity is the idea that acquire the opportunity and benefits of economic growth that should be widely shared by all segments of society.[37] Inclusive riverside implies to be in equal balance in public activities, urban array of heritage and the structure of the city, using active travel modes (walking, cycling). The potential in an inclusive river lies not only in its material resource but also in its unique location. The main arteries of transport infrastructure pass through the river. The study of the city

masterplan and field analysis demonstrate that it doesn't absolutely use the full potential of the coastal part on territory for the development of public spaces and connections to various monuments of urban heritage. It is necessary to move from the isolated development of public, green spaces and pedestrian zones to their integrated development based on the formation of green corridors and multifunctional zones. Table 3 describes the recommendations and necessary measures for spatial and aesthetic rehabilitation of Ganja city identification.

Forming a coherent system of multifunctional bonds which is mostly centred on the territorial and material resources of the river, the recommendations are aimed at: increasing walkability; creating a cycling system of sidewalks, bike lanes, transit-oriented places to view river landscape and heritage areas.

7. CONCLUSION AND LIMITATIONS

The "Soviet past" in its definition has more temporal relevance or refers to the remnants of that era. On the other hand, the "Soviet reality" conveys what is still somehow relevant today. Unfortunately, we have inherited impressive residual effects from the Soviet reality. To some circumstances, we treat some circumstances as normal by default. In the Soviet period, it was not worth to pay attention to cities identities, as it was something that could gradually lead to the independence of the republics. By considering selectively the history of an ethnic nation, the Soviet authorities endeavoured in every achievable way to neutralise and depersonalise the inherent identity of this or that nation. Soviet ideology has addressed to literature, painting, and music. Considering legislation, an identification of the "United and Indestructible Soviet Union" was performed strictly at this level. During that time, design norms, codes in architecture and town planning did not address urban identity issues. For that reason, at present, the previous standards are still used in current urban regulation which requires a new approach in terms of how the urban identity of cities should be preserved.

Culture is constituted not by a system of objects alone, but by a discourse that saturates these objects with meaning.[38] It is argued by cultural theorist Bhabha (1990) that we have to recognise the nation (or city) identity as being defined within a dialectical tension.

In this aspect, it is important to realise that the identification of local architecture relies on a general perception of the city's environment, an aesthetic dialogue with the history of the place. Aesthetic perceptions and image impressions play pivotal roles in creating associations and emotions, which are essential aspects of tourists' visiting experience in destinations (Crow et al., 2006; Bulut and Yilmaz, 2008). Moreover, the general perception of architecture in EU member states is evolving in line with the sustainability paradigm.[39].

The importance of the image of the city and the composition of the aesthetic sense of the environmental build requires upgraded regulations to protect the city's identity. This aim affected many republics after the collapse of the USSR.[40] As a result of the past years of "Soviet reality", the uniqueness of architectural styles imprinted in the image of Ganja was not maintained by the development of manufacturing of materials corresponding to the local colour.

The coastal areas of the river are not adequately utilised. The Ganja River has a large part of the undeveloped coastline. On the other hand, one of the reasons why it is not profitable to use local materials is because there is a shortage of progressive small-sized workshops for bricks and different fractions of river stones. There is no comprehensive program to encourage the local industries involved in the whole chain of maintenance of the city's identity and settlement. Due to decades when the riverbed has not been adjusted by engineering works, it has in some places wide parts of overflow and flooded areas. The complex planning to form the river coastline, and engineering on correction of the riverbed could renew the work of masonry workshops of multi-fractal application of river stone. River stone materials have the potential to enter the local and regional building materials market. Shoreline reinforcement is required and this work needs to be accomplished using natural materials instead of voluminous concrete blocks and limestone stone. Referring to the sustainable development goals, the use of local materials that are adapted to the

climatic conditions of the region can significantly reduce transport costs, promote the participation of local masters and maintain a style in accordance with the urban heritage of the region.[41] Revitalizing the knowledge of vernacular heritage, based on local materials and climate adaptive construction methods, encourages innovation towards contemporary low-energy of architectural models.

Without a commitment to long-term vision and strategy, the efficacy of these directives becomes significantly diminished. The imperative task falls upon mayors and officials within the ministry, charged with the responsibility of decision-making on behalf of the city, to articulate precise long-range concepts that prioritise principles of inclusivity and urban identity. Such measures are poised to foster sustained economic advancement while safeguarding our heritage. The establishment of viable urban environments does not invariably necessitate substantial investments but invariably hinges upon a judiciously balanced strategy.

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THE FUTURE OF THE PAST AT THE URBAN LEVEL: ACHIEVING URBAN HEALTH AND WELL-BEING WITH ARCHITECTURAL HERITAGE

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ABSTRACT

The definition of a city, given by the Italian Treccani Encyclopedia, is:
"Town of considerable extension, with buildings arranged more or less regularly, in such a way as to form roads of easy transit, paved, equipped with public services and whatever else is necessary to offer favourable conditions for social life (the concept of the city is linked to that of a multiplicity of functions of various origins and nature, economic, social, cultural, religious, administrative, health, etc., gathered in one place and for this reason is not conditioned by the number of inhabitants)".[7]
The city is, therefore, defined in relation to its possibility to promote social life. In these terms, consequently, the research carried out by urban planning can focuses on public health, the exploitation and use of the territory as a resource (meaning the territory in all its natural and man–made dimensions), focuses on the interest of man, as an individual and as a social being.
"An urban health approach considers cities as the modal form of human living and recognizes that such a commonly felt exposure must, by definition, influence much of what we do and how we do it".[16]
The future of Cultural Heritage is the main topic of the documents, rules and charters in charge to ensure its conservation. Cultural Heritage is a locution related to the natural or anthropogenic assets that are necessary to conserve and safeguard a group's identity.
Nowadays, the focus of the activities related to the safeguarding of Cultural Heritage has a wider horizon, including, also the well-being of a single individual and of a group.
Well-being means that people must find in the common good, which cultural heritage is, the object and the cause of wellness while living in a community or alone.
The concept of a common good must be understood and linked to the possibility of increasing the well-being of everyone for whom it is necessary to invest part of the common and social resources.
In order to reach these arguments, the paper aims to analyse the restoration and the conservation in relationship not only with the need to transfer to the future generation the traces of the past as an imperative condition, but also assuming the social, and economic value of assets that are common goods able to improve the well-being of the citizens. [4,13]

Keywords*: Cultural, architectural heritage, conservation, enhancement, city, common good, well-being*

Ey ağıllı qoca, deyilsən naşı, Torpaq ələyənin cavandır yaşı,
De, yavaş ələsin, çünki bu torpaq Pərviz bədənidir, Keyqubad başı.

Ehi, vecchio, inesperto non sarai, ma il contadino è giovane assai,
bisogna che rispetti questa terra: che è di Parviz e Keygubad, lo sai.

Hey, old man, you may not be inexperienced, but the farmer is very young, you need to respect this land: which belongs to Parviz and Keygubad, you know.

(Mahsati Ganjavi (XI-XII Cent.), Rubayyat.) [17]

Biz od üstündə doğulduq, Od üstündə yaşa dolduq. Alovlara düşdük, ancaq Əriməyən metal olduq. Yanğınları söndürməkçün, Od üstündə addım atdıq, Od üstündə ömür sürdük, Biz od üstündə yaratdıq.

Siamo nati nel fuoco, ma non siamo bruciati. Nelle fiamme cadendo, noi ci siamo temprati. Per sedare la fiamma, noi nel fuoco entriamo e nel fuoco viviamo, costruiamo, creiamo.

We were born in fire, but we are not burned. By falling into the flames, we have tempered ourselves. To quell the flame, we enter the fire and live, build and create in the fire.

(Mirvarid Dilbazi (1912-2001), Siamo nati nel fuoco) [17]

1. INTRODUCTION

1.1 Preamble

Baku, and in general current Azerbaijan, is the "result" of an extraordinary cultural stratification that needs to be known, shared and transferred to the future. With particular reference to Baku, it is immediately possible to grasp this important historical stratification that focuses attention on a past that, as is the case in all places and, therefore, cities of the world, does not only belong to the Azeri people. This awareness presupposes a sustainable approach to the management of the existing built heritage, which can and must always be considered of a cultural nature, precisely because it is always and in any case the expression of a precise cultural context in respect of which one must operate.

Goal 11 of the 2030 Agenda on Sustainability emphasises the role of cities in social development. " *Cities are hubs for ideas, commerce, culture, science, productivity, social, human, and economic development. Urban planning, transport systems, water, sanitation, waste management, disaster risk reduction, access to information, education and capacity-building are all relevant issues to sustainable urban development."*[10] Cities must not only facilitate the enjoyment of and access to culture: cities are culture.

2. LITERATURE REVIEW

2.1 City, history, and Baku

As Mumford states: "*The city, as one finds it in history, is the point of maximum concentration for the power and culture of a community. It is the place where the diffused rays of*

many separate beams of life fall into focus, with gains in both social effectiveness and significance. The city is the form and symbol of an integrated social relationship: it is the seat of the temple, the market, the hall of justice, the academy of learning. Here in the city the goods of civilization are multiplied and manifolded; here is where human experience is transformed into viable signs, symbols, patterns of conduct, systems of order." …. ."*Cities are a product of time. They are the molds in which men's lifetimes have cooled and congealed, giving lasting shape, by way of art, to moments that would otherwise vanish with the living and leave no means of renewal or wider participation behind them. In the city, time becomes visible: buildings and monuments and public ways, more open than the written record, more subject to the gaze of many men than the scattered artefacts of the countryside, leave an imprint upon the minds even of the ignorant or the indifferent*."

And moreover: "*Through the material fact of preservation, time challenges time, time clashes with time: habits and values carry over beyond the living group, streaking with different strata of time the character of any single generation. Layer upon layer, past times preserve themselves in the city until life itself is finally threatened with suffocation: then, in sheer defense, modern man invents the museum*." [28]

Mumford wrote in 1938, (the book cannot disregard his activism against the spread of fascism) his words highlight an entirely historical awareness of the city, seen as the product of the stratification of human will in its social dimension. Baku, the capital of Azerbaijan, has grown and developed since the mid-nineteenth century, following a Western idea of the city and implementing a European architectural and design culture. These management and approaches, in fact, don't seem to compromise the existence of old Baku: at least, they do not seem to do so any more than has happened in many ancient European cities. This expansion constitutes an urban layer of great historical value, to which the new expansions and constructions of the Soviet period will be added. Finally, to all of this is linked to the "black city", as the industrial and productive part of the city was called. The traces of the "black city" can and should be a necessary element in the knowledge and understanding of Baku and the reasons for the ways in which it developed.

2.2. Memory, History and Well-being as driving force for Cultural/Architectural Heritage Conservation

As Salingaros states: "*Associative memory is very important to architectural design. It can be responsible for powerful emotional experiences when we identify with what we already know, or which reminds us of something stored in our memory. In response to a small cue, which can be as trivial as a particular ornament, a color, or a fleeting odor, we selectively retrieve a specific set of linked memories quickly. A certain smell triggers recall of a past situation, and we remember a whole complex of memories linking emotions of the past moment with details of that event's physical environment, spaces, colors, sounds, etc*." [35]

But it is necessary to recall in the mind something that is very well known and, perhaps, physically present. As part of the same sustainable actions which, as mentioned, are introduced by the 2030 Agenda, it is necessary to address the issue of "urban regeneration" as a challenge for the restoration, conservation and enhancement of buildings and portions of the city. The practice of conservation must not, in this case, only draw its reasons from the intention of not losing memory, but from the awareness that the historical dimension of the city is part of the memory and of the life of the citizens ……can have a beneficial effect on the physical and mental health of citizens. By urban regeneration, agreeing with Lehmann means "*the capacity to solve multiple problems simultaneously (eg. social equity and human health issues, carbon emission reductions and infrastructure, liveability and housing)*". [23]

The conjunction between urban health, well-being and cultural heritage, and in this specific at the architectural and urban levels, constitutes an excellent reason to finalize interventions towards urban improvement not only aimed at transformation but also conservation.

"*When culture is reduced to a recreational pastime, when we fail to recognise heritage as a way of life that links both livelihood and identity, opportunities to enhance meaning and value in our lives are lost. To address this oversight, the impact of culture on sustainable development and wellbeing needs to be more clearly articulated and evidenced, so that it is recognised by decision makers, integrated within policy and harnessed for the benefit of communities at large*." [18]

We are invited to consider culture as the fourth pillar of sustainable development: "*The world is not only facing economic, social, or environmental challenges. Creativity, knowledge, diversity, and beauty are the unavoidable bases for dialogue for peace and progress as these values are intrinsically connected to human development and freedoms.*" [10]

The concept of knowledge is very complex. In this context we want to refer to the awareness of the articulation of one's own history, the value of collective memory as well as personal recollection. To this must be added the perception of the value (also economic) of the management of existing heritage. The knowledge process must start from the recognition of its necessity and from the fact that the conservation of documents and material signs (as constructions and buildings are) is a fundamental action (considering a sign as something able to make known itself or something else).

In this regard, it must be remembered that not everything, at different times, is considered a document capable of transferring the past into the future, and therefore not everything can be perceived by everyone as fulfilling a sense of well-being and attracting positive attention.

According to D'Onofrio and Truisiani there is a need for: "*...a new alliance between health and urban planning focused on the "quality of living", as the result of a coordinated set of integrated actions of a transversal and transdisciplinary nature, aimed at improving health and well-being in the cities. These actions concern: the urban form, the characteristics of the built environment, the organization of mobility, the dislocation and mixite of functions, the defense and use of green areas and meeting spaces, the safety and resilience of environmental components, and control of social and environmental costs. The success of these efforts does not require major interventions but a multiplicity of adaptable practices, based on a daily knowledge and information activity, and the activity of civic growth and community empowerment paths*." [14]

Going along with the Burtland Report [3,37] on sustainability, we need to take precise positions on the proper 'exploitation' of existing resources. Architectural and urban heritage are part of the existing resources: they constitute the environments in which our existence takes place and in which we must find the reasons for our well-being. It is also possible to approach the topic in terms of "economy of culture". The author of the paper is not an economist, but an attempt is made to project the issue of safeguarding heritage not only onto the horizons of history and memory, but also onto that of the real need not to disperse a heritage whose value is not only that of "representing culture", but it is also to "produce culture". [5]

If "culture" is a cluster of ideas, symbols, behaviours and dispositions historically handed down, acquired, selected and widely shared by a certain number of individuals, with which they approach the world, both in a practical and intellectual sense" then, again as Fabietti reiterates, "*cultures are different ways in which human groups sharing certain ideas and behaviours approach the world:...".* [15]

What must be drawn from these two statements is that projection onto one's own cultural context does not necessarily mean understanding what happens in different contexts: and this is always true!!: "*Do you really think that they know Azerbaijan in Russia? It is time to popularize Azerbaijan in Russia". The young generations after USSR collapse don't know Azerbaijan.*" [19. 30] Mis-knowledge, like memory/remembrance loss, leads us to impose, even naively and unintentionally, inadequate mental patterns.

For this reason, it seems appropriate to define "culture" also in these terms: *"Complex of social, political and economic institutions, artistic and scientific activities, spiritual and*

religious manifestations that characterize the life of a given society in a given historical moment." [8]

Talking about heritage, conservation means going beyond a vision of culture only linked to one's own reference system. The inevitable social, political, economic, artistic, scientific, spiritual and religious differences must be known and understood. Therefore, perhaps, it is necessary to talk about culture also in economic terms, in order to avoid "*an overestimation of conservation policies to the detriment of those of culture production".* The question, if anything, is to carefully define what is meant by "production of culture". [36]

2.3 Cultural Heritage, Conservation and Economy

Walter Santagata states: "*Cultural policies are divided into four functional categories: a) those that fall within the model of the conservation of cultural heritage; b) those that are part of the model of the production of culture; c) those that belong to the model of destruction of tangible and intangible culture; and finally, d) those that depend on negligent behaviour. This kind of subdivision seems to exhaust every possibility because culture is either preserved or produced or destroyed, according to an uncivilized model, or is neglected. ...*

Neglect and destruction of culture are negative policies. Conservation and culture production have a positive character. From another point of view, destruction, neglect and preservation are past-oriented policies, both positively and negatively related to cultural heritage. Production is a future-oriented policy, the engine for the development of new cultural industries." [36]

The term heritage means "the group of assets, movable or immovable, that a person (natural or legal) owns".[31] When does heritage become "cultural"? When is it capable of representing the culture of a people, according to what was said above and/or when does it produce culture? [27] Heritage takes on cultural value as soon as it is recognised as material evidence having civilizational value (this according to Italian law: Code of Cultural Heritage, 2004). [9]

Since civilisation is defined as: "*The particular form in which the material, social and spiritual life of a people (possibly of several peoples united in close relationship) manifests itself - either throughout its existence or in a particular period of its historical evolution*" [6], then we cannot but regard any human product of a particular historical period as a manifestation of civilisation.

If, therefore, we intersect the demands of sustainability with those of respect for civilisation, it turns out that everything around us must be subjected to careful analysis before we decree its voluntary destruction. The economics of culture, moreover, cannot fail to take an important aspect into account: that the culture of a people must not only be based on its, so to speak, "creative" capacities. Conservation should not be seen only in a negative sense of passive and costly action. The "cost" referred to is translated into "profit" at the moment in which conservation puts in place specialisations (both in terms of material production and in terms of intervention) that can only spur the activation of a given economic sector.

The economy of culture does not only look at the production of cultural goods, such as books, or the enhancement of archaeological sites, or the reactivation of museums because it is not possible to limit the set of goods that constitute heritage.

2.4 Valorisation and Quality of Life

Valorisation and enhancement, according to the Italian lows, in article 6, means: "*Enhancement consists in the exercise of the functions and in the regulation of the activities aimed at promoting knowledge of the cultural heritage and at ensuring the best conditions for the utilization and public enjoyment of the same heritage. Enhancement also includes the promotion and the support of conservation work on cultural heritage. 2. Enhancement is carried out in forms which are compatible with protection, and which are such as not to prejudice its exigencies*". [9]

For many years now, there has been a growing acknowledgement that heritage conservation is not just about preserving material goods, but rather about safeguarding and sharing heritage

for the betterment of people's lives and the environment. This implies a more proactive view of heritage as a tool for positive change and reflects a broader geopolitical movement to promote sustainability and well-being. .....

The prevailing world view that prosperity is synonymous with progress is changing. Economic measures such as GNP and GDP, adopted since the 1940s by the International Monetary Fund and the World Bank as a means of measuring development, have been the focus of growing criticism for many decades. And now the challenges of the 21st century, such as the climate crisis, mass migration, globalisation, food insecurity, land degradation and more, are further deconstructing this belief.

"*The global community is increasingly aware that a development model based solely on financial enrichment does not guarantee improvements in living standards and at the same time poses a serious threat to environmental stability. The current dominant parameters say little about how the benefits of economic growth are shared, and thus fail to address inequality and other pressing social issues. Consequently, there are growing calls for a more meaningful, holistic and sustainable development model that better reflects human needs and aspirations and is not limited to economic security alone*." [18]

The concept of quality of life serves to measure the well-being of the population in its various dimensions. Well-being, in fact, depends both on some material living conditions and on the individual perception of quality of life. Material conditions include income, employment and housing situation. [20]

The no-material dimensions of quality of life, however, include health, education, quality of the environment, personal safety, civic commitment, and the balance between work and private life. [20] The education, and the quality of the environment, including personal safety, are part of the well-being of the person and part of the management processes of the existing built heritage, whether it is of a strictly cultural nature or not (yet!).

3. RESEARCH OUTLINES AND APPROACH

3.1. Case of Study

The provided example concerns the regeneration of a portion of the "black city," particularly focusing on the structures related to transformation. The thesis, discussed by the student Kevin Prenna [33], is based on the studies he conducted starting from the course attended during his period of Erasmus studies in the Urban Planning course of Prof. Emir Huseynov.[1,22][1] The thesis attempted to verify the potential for the reuse of some disused industrial archaeology structures. The intent is to highlight how these structures have a high recovery potential in order not to erase the memory of spaces that constituted a very important phase of the economic, social and cultural history of the city and the entire country, putting into highlights the possibilities of restoring territories in order to guarantee the well-being of citizens.

"*As the extension of Bulvar is a crucial theme for the city of Baku and in obedience to the existent situation that considers the end of this urban element with the end of the New White City transformation, the direction of the project is to consider this element in order to continue that path until its last portion. This area is now characterised by many docks that serve many industrial actors and certain military areas. Proved this, the aim is musealising that area through the preservation of principal industrial buildings, that are testifying the industrial oil heritage of the city*." [34]

Starting from the analysis of the history of the city's development, the thesis tried to highlight the potential of the existing. [25, 26] The project developed in the thesis attempted to create a museum itinerary starting from the expansion of the *Bulvar* and the White City with the aim of

[1] The Erasmus exchange programme is held with Azerbaijan University of Architecture and Construction, Baku.

keeping alive some of the traces of a past that represents the life of the city and its inhabitants. The part analysed is made up of docks for industrial and military use.

Therefore, some were identified from the investigation of naturalistic, urban and industrial archaeology episodes, such as the different urban stratigraphy, the transport system, and the interface line with the Caspian Sea. The waterfront, in turn, has been divided into anthropogenic and naturalistic elements. The morphology of the coastline was analysed, with its main attractions and the plant and aquatic system that distinguishes it. In the overall industrial archaeology system, we wanted to highlight the storage containers and the oil platform of the State Oil Company of Azerbaijan Republic, SOCAR. In the project, the coastline is equipped with small and medium infrastructures, such as walkways and bridges that are able to mend the various jagged and functional elements only for large landing places.

Furthermore, a redevelopment is attempted in naturalistic terms, appropriately eliminating pollutants, and redeveloping the platform which becomes a scientific research center on lake biology. The analysis supports the restoration intervention and is useful for understanding how the building can be reused in all its parts, adapting them to today's technologies, performances and functions, guaranteeing a compatible use. The project is also based on the analysis of the social and urban context and the needs proposed by the public administration. The fourth presented project concerns urban regeneration, in the perspective of conservation, of some memories of the "Black City" and oil extraction on the coasts of the capital. The research developed in the master thesis had the aim of analysing the possibility of conserving some existing structures, from buildings to infrastructures, up to oil platforms, giving them new uses, preserving their historical memory, also in the material sense.

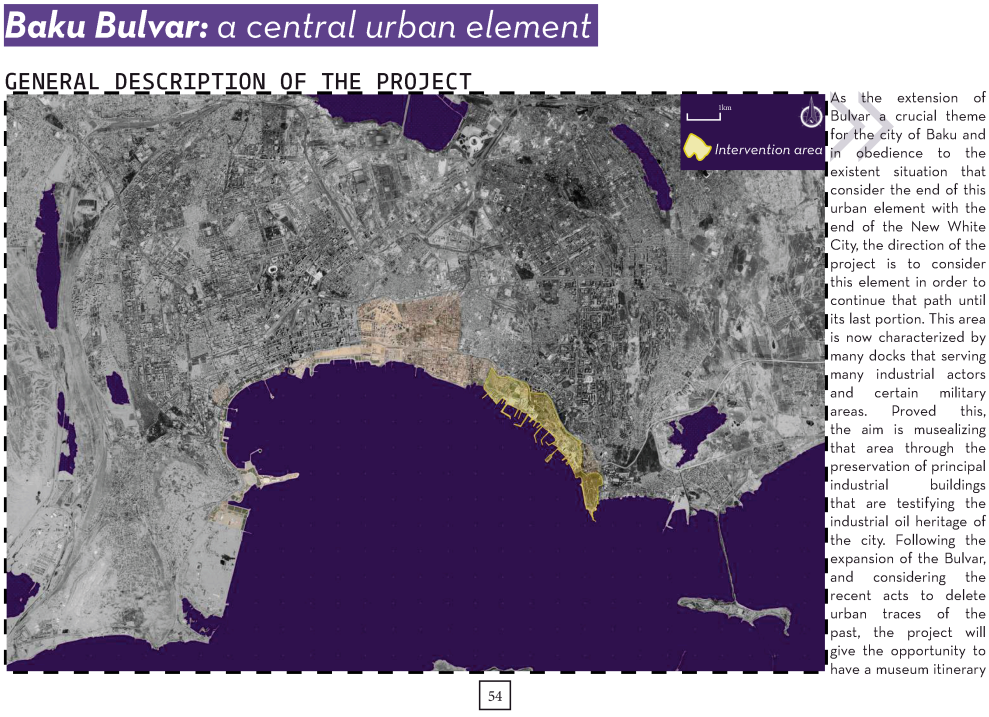

Figure. 1. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

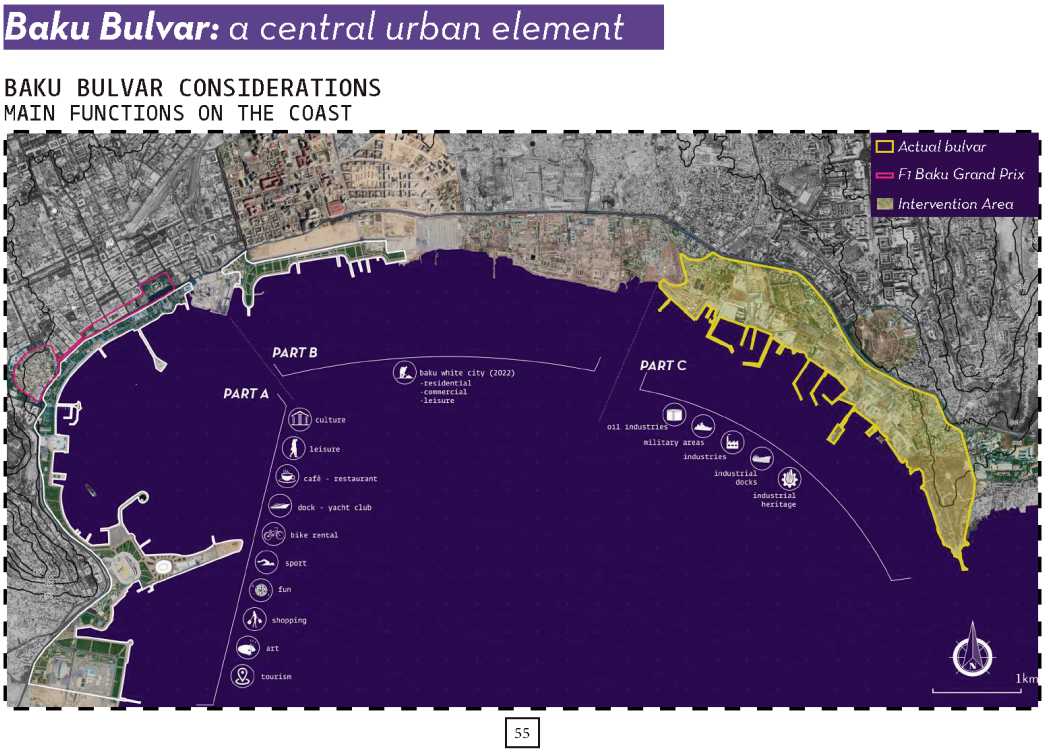

Figure. 2. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

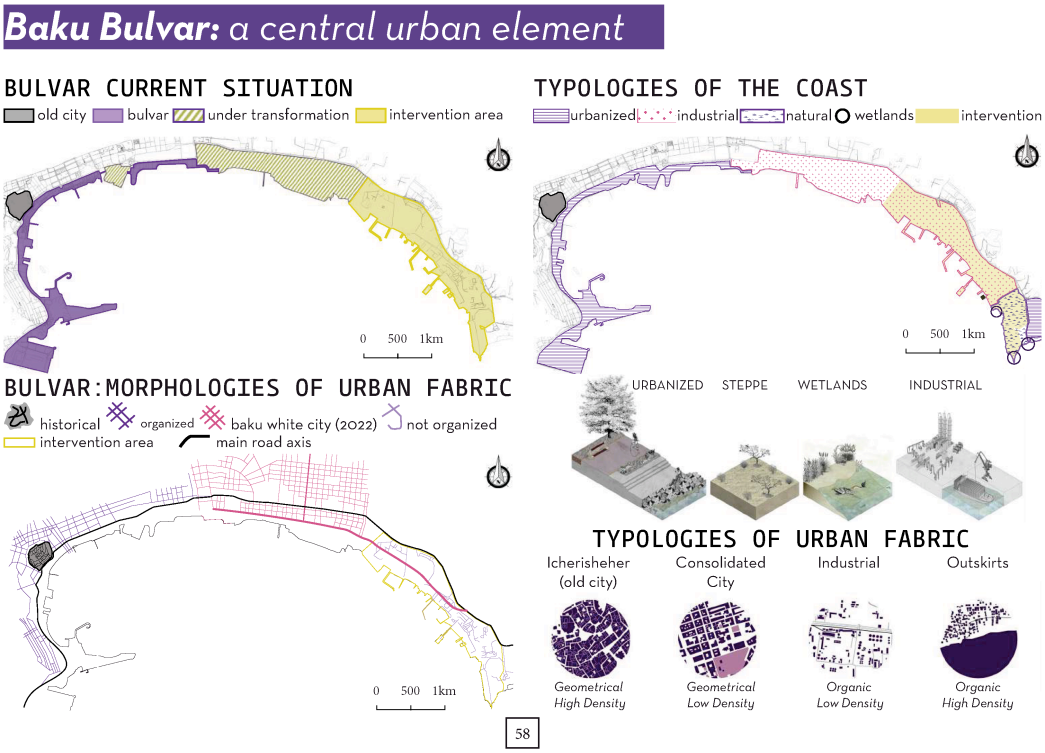

Figure. 3. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

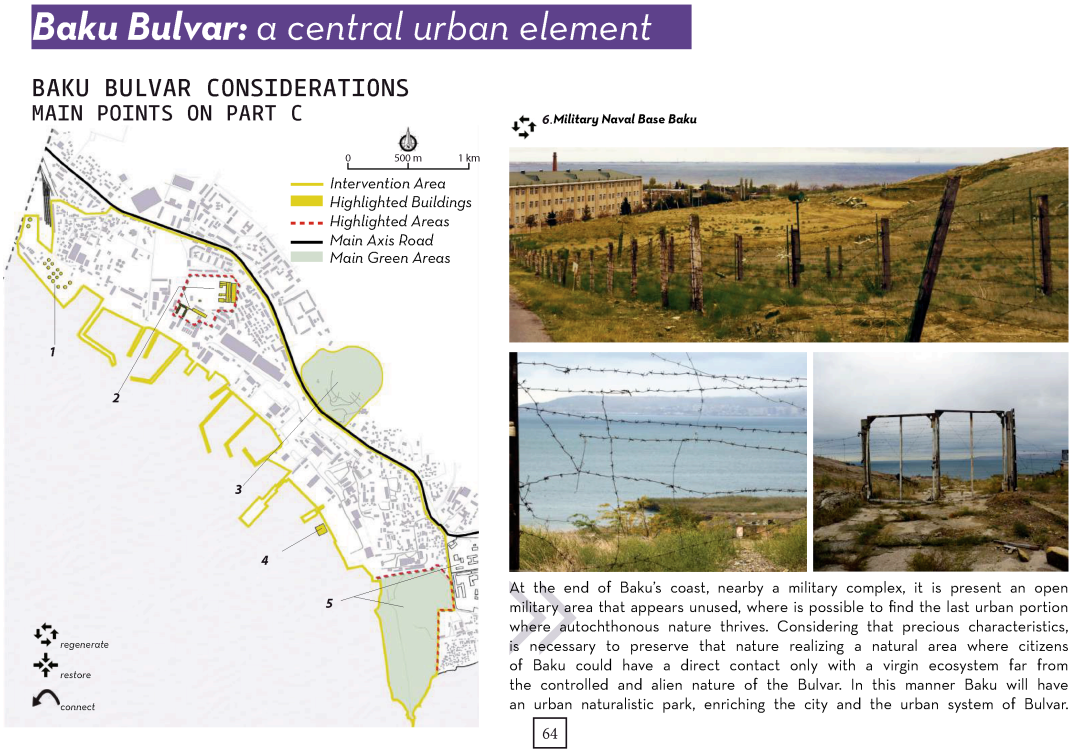

Figure 4. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

Figure 5. Prenna K., Baku bulvar, Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33,34]

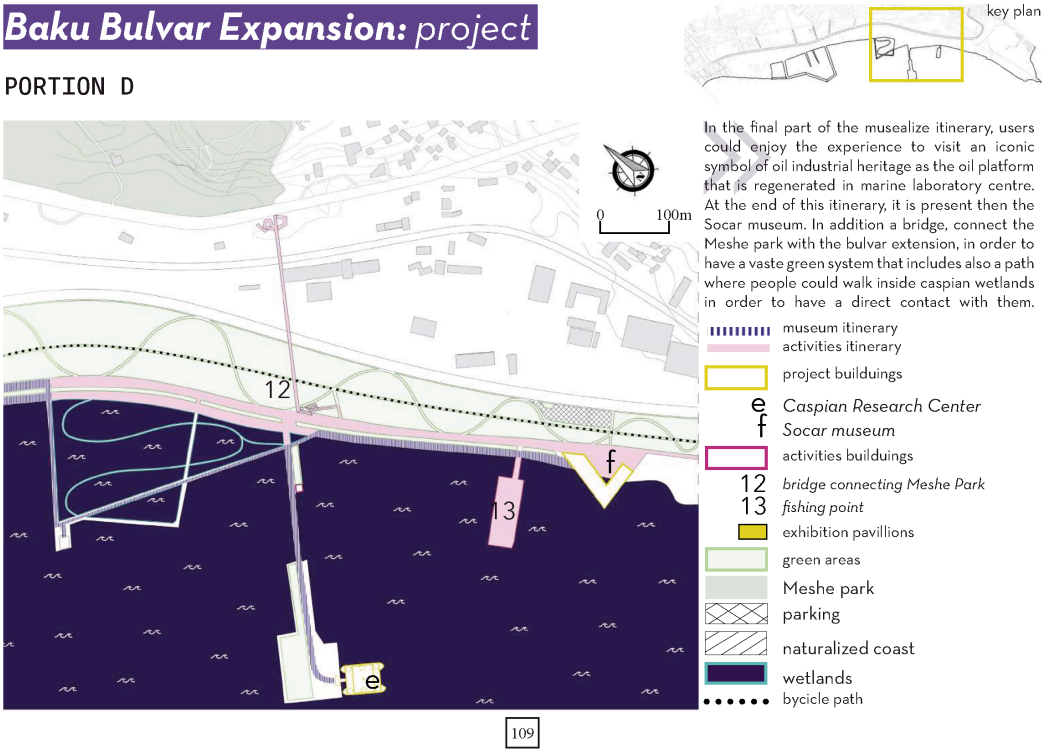

Figure. 6. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

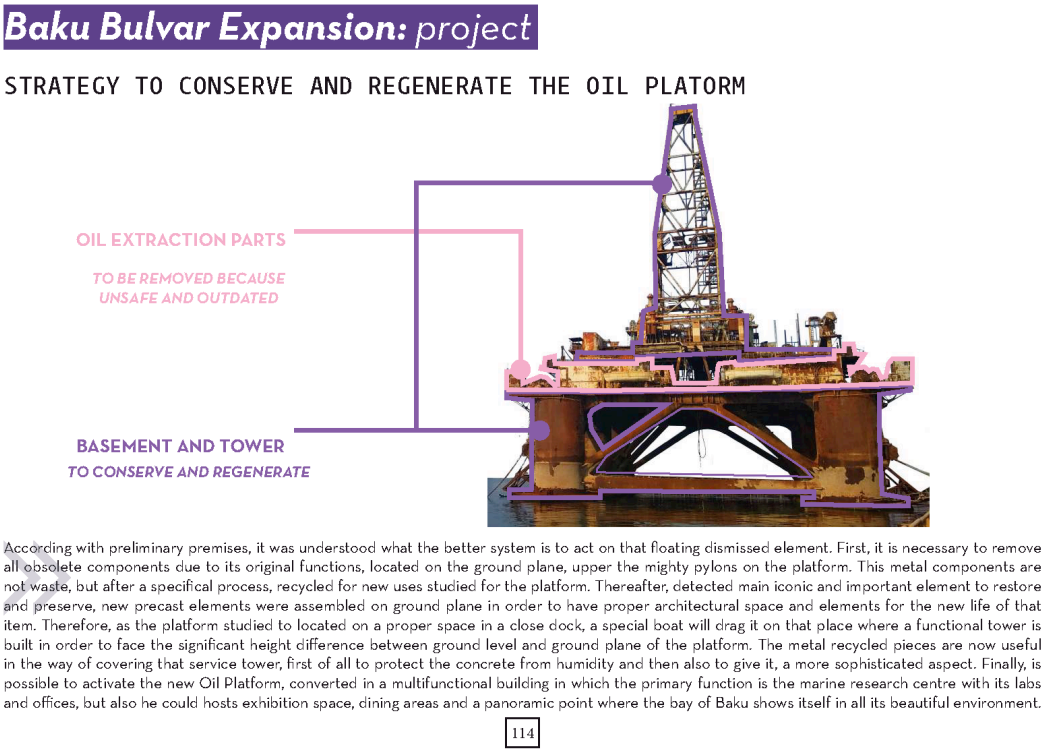

Figure. 7. Prenna K., Baku *Bulvar* Expansion: between oil and urbanism, Politecnico di Milano, Master Thesis, Thesis discussed on 2020/12/15. [33, 34]

4. CONCLUSION

The project started with the analysis of the context from historical, geographical, material and naturalistic points of view, highlighting the potential of the examined structures and verifying their conservation and reuse opportunities. The work manages to demonstrate how platforms, infrastructures and parts of the old oil processing system can be reused, including also the analysis of similar cases to understand their feasibility. The example presented takes into account not only the historical value of the artefacts but also the need to find solutions that can be sustainable in economic terms. They propose interventions that can be maintained in the future and guarantee the well-being of citizens, also through the conservation of traces (also at the urban scale) that are part of their memory.

There are no conditions to consider it "a place of memory", as defined by Pierre Nora [29] but its documentary value can be maintained and handed down with a design action capable of defining its historical meaning without resorting to selective, and rather historicist, solutions.

«*The historiographical cornerstone of selectivity seeks to answer the question of how and why we deal with a historical event by choosing it among an infinite number of others. This choice involves at least two problems, that of evaluation and that of the current motivations that lead us to study it*". [11]

In a detached ideological sense, the project is a moment of history: it must be able to narrate a story, recovering its documentary value, both according to *Denkmal*, as a document witnessing history, and according to *Mahnmal* [32], as an element capable of remembering and, at the same time, of warning. [24] Simultaneously, we can think about the improvement of the urban structure to enhance and encourage the use of cultural heritage, perhaps, the architectural heritage specifically, but it cannot be underestimated how much the conservation of this heritage, be it cultural or "simply" historical, can benefit people's well-being by becoming an instrument of urban health policies.

In general terms, these policies seek to improve the well-being of citizens through urban regeneration. The regeneration criteria can refer to the conservation project which stimulates a process of comprehending, restoring and subsequently maintaining heritage assets [12], which is meticulously tested and recognized as valid not only as a suitable intervention for the cultural heritage but also as a guarantee of preserving the memory of places in a sustainable way.

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OPPORTUNITIES AND CHALLENGES OF URBAN DEVELOPMENT PLAN IMPLEMENTATION: THE CASE OF ENEWARI TOWN, NORTH SHEWA, AMHARA REGION, ETHIOPIA

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ABSTRACT

The main goal of this research is to explore the opportunities and challenges faced in implementing a local development plan in Enewari town, located in the North Shewa region of the Amhara Region, Ethiopia. To achieve this goal, we used a combination of descriptive and explanatory research methods. The author collected data from both primary and secondary sources. The author distributed questionnaires, consisting of both open-ended and closed-ended questions, to 210 respondents chosen through random and purposive sampling methods. Then, we analyzed the gathered data using both quantitative and qualitative approaches. Our findings revealed several important points about the town's development. Enewari town has valuable resources that could support its growth and the creation of a detailed project plan for its future. However, we also identified significant challenges. These include informal settlements, a lack of organized structures, high unemployment rates, limited public involvement, scarcity of available land, and difficulties in attracting investors. These obstacles are hindering the town's ability to implement its development plans within the specified timeframe. Overall, addressing these challenges will be crucial for Enewari town to achieve its developmental goals effectively.

Furthermore, the limited availability of land presents a formidable barrier to the realization of ambitious development plans, necessitating innovative approaches to land use and allocation. Concurrently, attracting investment remains a critical imperative for unlocking the town's developmental potential, requiring concerted efforts to showcase its unique value propositions and create an enabling environment for private sector participation.

Keywords: *Development plan, public participation, institution, informal settlement, and potential*

1. INTRODUCTION

Land is the basic and unique natural resource for human beings, which today, has reached a stage of scarcity in urban areas as a result of rapid population growth and urbanization process (Buhaug & Urdal, 2013; Gondo, 2013).[5][16] (Oberai, 1993) stated that rapid urbanization, the growth of large cities, and the associated problems have emerged as the major socioeconomic issues with potentially important political implications in many developing countries.[29] Urban areas in a number of developing countries are growing largely at unprecedented and challenging paces and rapidity by posing serious challenges (Dube, 2013; Mukhopadhyay, 2013).[10][27] Since they are places where challenges and opportunities of development meet, they need to be adequately planned and effectively guided by local urban development plans to create enabling environment for their expansion, functional specialization and cultural expression and sustainability (Devas & Rakodi, 1993).[8] Therefore, urban planning plays a vital role in guiding, leading, directing, and managing urban spatial progress starting from the past to existing along the countryside (Friedmann, 2005; Yeh & Wu, 1999).[13][41] The presence of urban plans and their effective implementation is highly important for the proper use and administration of resources in urban areas also a crucial tool to attain sustainable urbanization (Angelidou et al., 2018; Yigitcanlar & Teriman, 2015). [2][42]

In addition to urban planning, local development plans have become an important component

of holistic development strategy planning, not only in Africa but in every state in the world (Linders, 2013; Stiglitz, 2002).[25][39] However, the development of a city based on plans is a recent history in Ethiopia. Urban development is guided initially by the intents and visions of its governor's body. Later, a number of master plans were introduced at different times to guide the development of most urban areas. The absence of enough details to implement the master plans and the dissatisfaction with the ease of implementation of master plans gave rise to local development plans that are believed to realize the master or structure plan of most towns and cities (Burby, 2003).[6] Similarly, the preparation of an urban development plan for a town however does not ensure implementation of the proposals as conceived by the plan. A comprehensive implementation framework based on judicious allocation of financial and institutional resources in a coordinated manner is mandatory for the successful implementation of a plan (Admasu & Jenberu, 2020; Hameed & Nadeem, 2008).[1][17] In addition, practical realities in many developing countries reveal that urban planning documents master plans/structural plans are less responsive to the pace of urban growth as well as residents' need (Dube, 2013).[10] Thus, after completion of all the elements of the plan, special attention is needed to focus on implementation tools. These tools include; legal protection of the plan, capital improvement of the programme, zoning regulations, land sub-division regulations, building regulations, and urban renewal programs (Biswas, Rahman, & Akther, 2016; Hameed & Nadeem, 2008).[4][17] There is, however, no clear evidence indicating to what extent these elements of urban planning were considered in Enewari town development plan. On the other hand, there are a number of influences that affect the effective implementation of a town development plan. Hence, a number of studies have been conducted on urban development plans implementation by different researchers and writers in the last few years. For example, (Semeneh, 2015) studied the implementation of local development plans in Addis Ababa.[38] In this study he showed a number of obstacles to the implementation of LDPs. These includes unsuccessful poor integration, lack of strategic focus, prioritization and action, lack of clear regulations, unclear institutional hierarchy, outdated and unclear compensation policy and system, changing policy, unclear regulations for designation and colour coding. Another study is done by (Gashu & Feyisa, 2022) on challenges of urban plan implementation in small towns of Ethiopia in the case of Gelan town.[14] In this study a number of problems were discussed which are presence of ground water catchment area within the planning boundary and presence of some investments before and after the establishment of the town.

Furthermore (Negeri, Guta, & Erena, 2022) has studied the practices and challenges of urban planning in Ethiopia in the case of Nekemte Town.[28] In this study, a number of obstacles were identified, including physical, social, economic, political and capacity challenges. Besides this concept, (Admasu & Jenberu, 2020) urban planning implementation challenges were encountered in the town of Arbaminch in southern Ethiopia.[1] This study discusses the factors that hamper the appropriate implementation of urban planning guidelines. These include the lack of local development plans and updated plans; the lack of structural plans at the city level; the poor land information systems; the problems of good governance and the weak institutional framework were identified as critical challenges. However, the researchers listed above did not address the issue of informal settlement, the existence of unemployment, the low supply of land, the lack of investors and the lack of public participation in the implementation of urban development plans. Thus, taking into account the findings and gaps identified in other urban areas of Ethiopia, this study attempts to investigate the challenges encountered in the implementation of the urban development plan in the city of Enewari.

2. METHODOLOGY

2.1. Research design

Research design is the arrangement or procedure of data collection and analysis conditions to ensure their relevance to the purpose of research (Kothari, 2004).[23] The research design chosen is determined by the objectives of the research in order to answer the research questions of the research problem. Thus, the research used descriptive and explanatory research design strategies to investigate a phenomenon first from the perspective of participants/key informants in order to better understand the research problem.

2.2. Research Approach

As (Lofland & Lofland, 1995; Sechrest & Sidani, 1995) pointed out, when combined, quantitative and qualitative methods complement each other and enable more comprehensive analysis.[26][37] As a result, the research used the qualitative and quantitative methods of this study, which are procedures for collecting and analyzing quantitative and qualitative data at the corresponding stages of a research process in a single study, to better understand a research problem and to obtain a deeper clarity of the qualitative and quantitative results simultaneously. In addition, it improves the good use of triangulation and a practical, problem-driven approach to understanding a research problem.

2.3. Source, Type, and Data collection instrument

The research used both qualitative and quantitative data types to improve evaluation. In order to obtain appropriate data, it used primary and secondary sources of information. To achieve the research objectives, different data collection instruments have been used. The primary data were collected from questionnaires (open and closed), interviews with key informants, focus group discussions and field observations. And the secondary data were articles and annual reports of the town.

2.4. Sample Size and Sampling Techniques

The target population for the study is the inhabitants of Enewari Town and the municipal employees. Therefore, in order to conduct the target population of the study area, the study area has six zones, of which are 01, 02, 03, 04, 05, and 06 with 709, 281, 478, 913, 322, and 125 households respectively. Also, there are 51 administrative staff in the municipality. Of these zones, Zone 02 was selected with a simple random sampling using a lottery system. The target population of the study area is therefore the household population of Zone 02 (281 households) and the staff of the municipal offices (51). Based on Yamane's simplified formula for calculating the sample size in Table 1. In 1967, the researchers used a 95% confidence level and a 5% precision level. Therefore, the representative sample size in this study is 210.

$n=N/ (1+N (e)^2)$

Where n is the sample size, N is the population size, and e is the level of precision. For town resident; $n=281/ (1+281 (0.05)^2) =165.1\sim165$. For municipal staff employee; $n=51/ (1+51 (0.05)^2) =45.2\sim45$

Table 1 Sample Distribution of Respondents (N=332)

No	Key respondents	Target population (N)	Sample size (n)	Percentage (%)
1	Zone 02	281	165	78.6
2	municipality and Kebele administration office	51	45	21.4
Total		332	210	100

In this study, probability and non-probability sampling methods were used. The probability sampling method applied simple random sampling techniques to questionnaires of urban households and city employees. In addition, from the non-probability sampling technique, a proposed sampling technique was used to select three elders and three municipal experts who

could provide good information for this study from urban residents. Two FGDs were selected, including seven and nine members.

2.5. Method of Data Analysis and Presentation

The research used qualitative data analysis to answer questions such as why, what, how, what was obtained from interviewers, key informants, field observations, focus groups discussions and written documents. The study also uses numerical data analysis to analyze and present the collected data using relevant computer software (STATA). The quantitative data were analyzed using multiple linear regressions to determine the causal relationship between independent variables and the effects of independent variables on dependent variables. The regression model is $Y=\beta0+\beta X1+\beta X2+\beta X3+ \beta X4+\beta X5+ \beta X6+\mu$.

Where: Y= Dependent variable (development plan implementation), β0=constant term, X1= institutional set-up, X2= informal settlement, X3= public participation, X4= existence of investor, X5= land supply, X6= unemployment, and μ= error term. β= coefficients associated with each independent variable which measure the change in the value of Y per unit change in their respective independent variables (X1, X2, X3, X4, X5, and X6). The equation has a linear relationship, and the reaction to the independent variable's influence on the dependent variable is measured by calculating indices based on information from the Lickert scale.

3. RESULT AND DISCUSSION

3.1. Development History of the Town

Like any other town, Enewari town has its own development history. It is one of Ethiopian towns which are located in Semen Shewa zone, particularly in Moretina Jeru woreda. According to key informant interviews, document analyses, and questioners, the village was established in 1935. During the Italian invasion (1935-1941), the town was given the name *Mishg*; however, following the Italian invasion, the town's name was changed to Enewari. For a long time during that period (Emperor Hailesilassie regime), the town was ruled by an *atibia-dagna* (village chief). After the Hailesilassie regime fell, the Derg regime founded Kebele. Until 2001, this Kebele was in charge of the town. The town municipality was also founded in 2001 during the Ethiopian People's Revolutionary Democratic Front (EPRDF) period, with a staff of five professionals. The town was controlled by the town municipality throughout this period, which developed into urban administration in 2021. The town has been administered by the urban administration since it was granted urban administration status.

Based on information obtained through key informant interviews, questioners, and field observation, the town has undergone various changes in terms of its size and demographics, financial and economic structure, and physical and geographical relationships since its foundation in 1935. During the period of Emperor Hailesilassie, the town experienced a variety of infrastructure advancements, including schools, roads, water, and telecommunications. Whereas, during the Dergue era or the socialist period (1974-1991), urban land and extra dwellings were nationalized, and the maximum margin for private capital accumulation was fixed. This has stifled investment, economic progress, and urban expansion. On the other hand, with the exception of a few infrastructure provision changes, the town's infrastructure development during the Derg period was comparable to that of Emperor Hailesilassie.

Post-Dergue Period: From 1991 until the present, a thriving private sector has been permitted to thrive, and as a result, the local economy has grown. Under EPDRF, Enewari began its change to well-organized institutional advancement and structure, and the town's development has been considerably better than in the previous two regimes. Infrastructure provision development was also partially completed. Furthermore, the institutional mechanisms for directing town growth were better than in previous regimes, and a local development plan was initiated to guide town development.

3.2. The process of Town Development Plan

With increased urbanization, various land uses such as administration, commercial, recreation, industrial, residential, urban agriculture, social services, utilities, and infrastructure development are formed within the urban core. These all-diversified urban specializations and residents' activities need a plan to regulate in maximum fairness or to control development. As a result, urban planning is one of the principal important tools to guide the growth of urban areas towards opportunities than challenges elsewhere (Negeri, Guta, & Erena, 2022).[28] Based upon the information gained from key informant interview, prior to the town development plan, the town had been expanding in an undesirable manner, and infrastructure delivery was also inadequate. The town government had devised local development plans in order to manage this unwelcome growth, build a fascinating town, and bring infrastructure in a sound manner. Hence, As obtained from key informant interview, document interviews, document reviews, and questioners, Enewari town has had three local development plans prepared by the national urban planning institute and the Amhara region urban planning institute since its inception; the first and second revised local development plans of the town were prepared by the national urban planning institute in 1989 and 2001, respectively, whereas the third or current revised LDP was prepared by the Amhara region urban planning institute.

Urban plans have a wide range of beneficial and negative effects due to their involvement in urban development. Individuals, members of local groups, communities, and society as a whole, occupiers and users, and members of present and future generations all have various interests when it comes to urban planning procedures and outcomes. According to the information received from respondents, the plan has influenced some residents' social and economic rights; thus, when the occupant's house was completely demolished for redevelopment purposes, they were given another residential area and compensation for their lost goods. However, if a property is not completely demolished, no residential space is provided; however, compensation is provided for only the property lost as well as the confiscation of their land. Even if the residents received compensation for their damaged property, the amount of money received was insufficient to rebuild another residential dwelling and support their families. As a result, the occupants suffered both economically and socially.

3.3. Opportunity of town development

According to Ramukumba (2012), local development is a process in which public, private, and non-governmental sector partners collaborate to create a better environment for one country's profitable growth.[32] The goal of development is to maximize the value of the land, minimize the costs of acquisition and procurement, and provide a higher and better use of the property. Furthermore, it resulted in a more accurate diagnostic assessment of local economic assets and distinguishing advantages, as well as a more aggressive strategy assessment of the municipality. (Kisman & Tasar, 2014). The potential of local communities to improve their quality of life and create new economic possibilities must be considered when measuring the effectiveness of the local development planning process. Creating chances for productivity increases through encouraging the adoption of new creative technologies in manufacturing and growth is critical, as is the competitiveness of local enterprises (Ivanov, 2018).[18] [22]

The main obstacle of plan implementation, according to municipal employees, is a lack of financial resources. As a result, the municipality has a range of options for resolving its financial problems. According to Kisman and Tasar (2014) [22] A local development plan is essential for comprehending a town's local and detailed capabilities. This is good because if the local development plan is not backed by local resources, the city's share of national resources will be insufficient to reach the required degree of development. The major goal of a local development plan should be to grasp local strengths and maximize their benefits. As a result, in order to effectively implement the local development plan, the town administration should create a detailed plan based on local resources. As a result, various industrial project plans should be based on local resources. As a result, the community has enormous potential for future

expansion. Among the key potential are agricultural productivity (livestock fattening, crop farms, and vegetable production), construction materials (quarry), closeness to other towns, good rural-urban connectivity, and a well-developed transportation network.

3.4. The Challenges Faced in the Implementation of the Town Development Plan.

This section investigates the elements that inhibit the proper implementation of the town's local development plans. According to the information and data gathered from the questioner as well as the interviews conducted with study informants, the implementation of the town development plan has experienced a number of problems. Some of the major challenges encountered during the implementation of the development plan include a lack of organizational structure, the presence of informal settlements, a lack of budget, a scarcity of investors, a scarcity of land, a lack of public participation, corruption, and the prevalence of massive unemployment.

Weak Institutional Arrangements

Institutions, according to Yuan et al. (2019), represent the rules of a society or the humanly set up limits which govern human interaction.[43] The control of collective transitions as an underlying determinant of development's long-run performance is referred to as institutional arrangement. (Schmidt & Radaelli, 2004).[35] It also links technical innovation, the market, behavioral variables, and regulatory and legislative frameworks that encourage improvement. (Cheru, 2017; Schot & Geels, 2008).[7][36] The main function of the institutional structure is to restrict the choice set of actors by structuring human interactions (Qian, He, & Liu, 2013).[31] In general, an institutional arrangement is a set of agreements that govern the division of responsibilities among institutions involved in the collection, compilation, and dissemination of data in a specific domain. Policies, systems, processes, and structures used by companies to efficiently plan and manage their activities, as well as successfully cooperate with others in carrying out their responsibilities. As a result, it is critical to develop legal and institutional frameworks for monitoring the town's operations. According to the information gleaned from document research and key informant interviews, the first institution was the Kebele, which was established during the Derg period to regulate entire town growth in financial, economic, and political terms. After a long period of time, the municipality was founded in 2001 with three male and two female employees. The town municipality was then promoted to urban governance in 2021.

When compared to the previous one, the institutional setup was also enhanced in terms of financial, manpower, and policy formation. Nonetheless, it was ineffective for governing urban development. the information obtained from key informant interviews and focus group discussions, all local urban administrators and employees were not involved in the preparation of local development plans; there was no participation from the people who built, use, and live in the town; and there were insufficient experts in each specific field, such as Tele, land development agency (LDA), Roads Authority, agricultural authority, investment authority, Water and Sewerage Authority (WSA), and Electric Power Corporation (EPCO). Furthermore, Ohno and Shimamura (2012), believe that cooperation among multiple sectors and stakeholders, as well as the establishment of monitoring and evaluation procedures, are critical to achieving the goals.[30] In contrast, based on information gathered from key informant interviewers and focus group discussions, the working relationship between the various sectors involved in LDP implementation in the research area was weak and unguided by clear laws.

In addition, the town governance is decrepit; there is a low amount of revenue collected from various revenue sources, a lack of trust due to bureaucratic corruption, a high level of rent seeking, a lack of money for service delivery, the staff of the municipality is unethical when providing services to clients (users), and there is no separation between front-office and back-office. Furthermore, there is a lack of appropriate availability of technical equipment (computer, working office, and service). Furthermore, it lacks the funds to adequately and efficiently govern the municipality. Ineffective capacity building; the town government lacks skilled professionals

capable of delivering local services and carrying out effective local administration. In addition to frequent personnel turnover and a lack of organized data or information, institutional recollections of information are hampered. Another issue impeding the implementation of local development plans in Enewari town is an unclear collaborative arrangement between the various public entities.

Other research supports the effect of weak institutional arrangements on local development plan implementation; Engida (2013) stated that poor registration, documentation, and data management systems, as well as a lack of coordination and commitment from different stakeholders and the municipality, are barriers to local development plan implementation.[11]

Existence of Informal Settlement

Among the hurdles to development plan implementation is the presence of informal settlements, which has an impact on the implementation of local development plans. Informal settlements and slum neighborhoods, as detailed in (Diab, El Shaarawy, & Yousry, 2020), have become a manifestation of urban disparities, poverty, and a lack of access to decent housing. Slums are defined as a wide variety of low-income settlements with inadequate human living conditions, such as spatial and behavioral criteria.[9]

The Impacts of Informal Settlement Based up on Irregularity

An irregular (non-planned) town building is a component of an informal settlement that has an impact on the execution of a town development plan. Informal communities, according to Wakefield and Tait (2015), are frequently unplanned and have little infrastructure.[40] It results in an unstructured collection of structures that have a negative impact on the appearance and image of the town. According to the information gathered from respondents (key informant interviews, field observations, and questioners), the negative impact of an informal settlement includes unplanned use of land and unfavorable provision of facilities such as water, sewerage, and electricity. The quality of dwellings also limits outdoor spaces and leaves little space between buildings, diminishing spatial features. People living in informal settlements are compelled to live in an area devoid of open spaces and recreational opportunities, as well as limited movement and access to residential units, making services such as emergency provisions and rubbish collection extremely difficult. Nevertheless, Infrastructures are very critical utilities for advancing growth and improving living circumstances. As a result, adequate finance is required to redevelop those informal settlement. However, due to a lack of financial resources to reconstruct an informal settlement area, the implementation of the town development plan has been delayed and will be carried over to the next plan.

The Impacts of Informal Settlement Based up on Illegality

The unauthorized ownership of property is another aspect of an informal settlement that impairs the implementation of a town development plan. According to Sandoval and Sarmiento (2020), informal housing can refer to any sort of dwelling that is illegal because it is not under official supervision or regulation, or that is not protected by municipal legislation.[34] On the other hand, it is residential zones where residents have no land rights, with methods of unlawful possession of houses and rooms, and properties that are not registered in their own name. As a result, as best as one can determine, the information obtained from respondents (key informant interview and questioners) suggested that such informal settlers do not pay taxes to the government. As a result, the municipal government loses money from the property tax. When an area is designated for regeneration, and the government wants it for public use, the residents do not go voluntarily. Furthermore, by dismantling illegally constructed infrastructure, the government incurs significant material, financial, and manpower costs to complete the demolition effort. Accordingly, the town development plan's execution is not completed within the time frame specified. Other academics agree with the study's findings regarding informal settlement. According to Juma (2020) research, unregulated settlement causes physical disorder,

uneconomic land exploitation, and excessive encroachment on agricultural land, as well as environmental degradation, inadequate infrastructure provision, and pollution hazards.[19]

Acceptance of New Town Development Plan and Public Participation

The non-existence of public participation in any aspect of a development plan is a cause for concern about the proper implementation of the development plan. As stated by (Keeton & Nijhuis, 2019), urban planning is supposed to involve all relevant stakeholders in order to incorporate unforeseen urban activities during the planning and implementation process.[20] Involvement of community members in decision-making processes, as well as implementation and evaluation of planning issues, play a wide range of roles in facilitating cooperation between local governance structures and community members, as well as repairing municipal structures, municipal systems, and the planning process. Significantly, the interests of the communities must be involved in the business of the local municipalities. (Kgobe & Mamokhere, 2021).[21] However, the evidence gathered from respondents (key informant interviews, focus groups, and questioners) suggests that the modern urban planning rules did not appear to be functional from plan groundwork to plan implementation in the municipality. The town's successive plans were developed by town planners and zonal and regional urban planning experts without the participation of the local community, urban residents, civil servants, women, the business community, and religious leaders; thus, the contemporary bottom-up approach was far from reality in terms of planning actions in today's context of Enewari.

Further, the planning process was carried out in a closed environment, with a team of surveyors, economists, and data collectors doing the planning on their own; as a result, the top-down strategy was unable to produce the expected results. Because urban dwellers, women, elders, the local community, religious leaders, public workers, and the business community did not rush to participate in the drafting of the town plan. Thus, based on the information gathered from respondents (key informant interviews and questioners), the community does not accept the new town development plan because the community's interests are not reflected in the town's development plans. Even if they accept regarding the municipal development plan, they are skeptical of active plan execution. This practice causes friction between people and government entities, as well as delaying the completion of the municipal development plan for a future period of time. This study's findings are analogous with the findings of other studies. The research findings of Bhusal and Pandeya (2022) demonstrated that ordinary people's participation in local development planning has a significant role.[3] In addition, the absence of formal public participation during the plan preparation and approval process has a negative effect on the implementation of town development plans (Hameed & Nadeem, 2008).[17] However, in response to these limitations, Admasu and Jenberu (2020) underlines the need to promote active public participation and other stakeholders in the preparation and enforcement processes of urban plans as this will create a sense of ownership of the development plans.[1]

Shortage of Investor

Apart from different contests things, LDP implementers believe that there are issues arising from a lack of investors that impede LDP implementation. According to Kozera, Dworakowska-Raj and Standar (2021), the development of every local government unit is dependent on investment projects, and infrastructure investments have a favorable impact on the development of such units.[24] Local infrastructure investment projects aimed at assisting the growth of local government units should stimulate the building of spatial links between settlement units as one of their target purposes. In addition, Rosner and Stanny (2017), investments made by municipal governments are not intended to generate economic returns.[33] The main purpose, however, is to meet the demands of local governments and communities. And investment activities help to improve the living conditions of local communities and address their demands more effectively. However, according to information obtained from respondents (key informant interviews and questioners), the majority of investors are solely concerned with increasing their profit and are

not interested in alleviating residents' problems based on a plan. It is not interested in investing their wealth according to a strategy. Even if some investors are eager to invest their resources, the municipality's staff begs for money in an informal manner when the investor asks inquiries about investing their resources. On the other hand, the town government's initiative to mobilize private investment in development activity is not matched by the availability of town resources. The other reason is a lack of a good road network, as discussed in detailed in the opportunity section, and a scarcity of available land for lease. As a result of these factors, the number of investors putting their money into the town is minimal. Accordingly, all initiatives included in the plan that are carried out by the investor are not completed within the time frame specified.

Insufficient Supply of Land

In this case, the lack of land is a barrier to a country's development plan implementation. The availability of land in metropolitan areas helps to encourage economic growth and meet the housing, industrial, and commercial needs of rising human populations. As a result, land acquisition for public use is a vital phase in many urban developments; yet, it is often difficult and costly in terms of time, money, and political capital. Furthermore, land receiving typically entails the resettlement of existing tenants and landowners. Its usage for public purposes is sometimes the subject of passionate discussion. Attempts, for example, to value land at market prices in order to recompense owners for public good. This discussion is centered on the critical issue of the influence on land values and adequate remuneration for the owner (Freire, 2006).[12] Accordingly, the information gathered from respondents (key informant interviews and questioners) revealed that the supply of land in the town is insufficient for town development because landowners are unwilling to transfer their land to the government for public purposes (residential, industrial, and service, among others). Because the compensation sum paid to the landowner is insufficient to support their family. On the other hand, the amount of money that they (landowners) earn from informal land transactions is more than that obtained from government compensation. The government also lacks the financial means to compensate the landowners. Furthermore, the demand for any sort of land use is always larger than the supply of land, and with the faster expansion of urbanization, urban land resources are becoming increasingly scarce in the town. Consequently, there is an insufficient supply of land for residential home building, industrial development, service-providing sectors (schools, health centers, hotels, market places, leisure areas), and small and medium enterprises. As a result, all development proposals included in the plan are not implemented on the ground within the time frame specified.

Prevalence of Huge Unemployment

The occurrence of massive unemployment is one of the hurdles to the effective implementation of town development plans. As stated by Glaser, Dixit and Green (2002), unemployment has been a problem of economic and social dimensions, displaying clearly the weaknesses in economic institutions and social failures at the national level. It is regarded as a harmful social disease that has the potential to erode human skills and reduce opportunities for progress and economic well-being.[15] Unemployment has a devastating effect on people's lives and affects their living conditions. The loss of income by parents can harm the prospects of the next generation. According to the information obtained from respondents (key informant interviews and questioners), the presence of high unemployment in the town causes financial hardship and poverty, debt, homelessness and housing stress, family tensions and breakdown, boredom, alienation, shame and stigma, increased social isolation, erosion of confidence and self-esteem, deterioration of work skills, and promotes social unrest and conflict. As a result, it has an impact on the implementation of the town development plan by causing resource waste, increasing poverty, limiting labor mobility, and generating social unrest and conflict.

3.5. Inferential Statistics

When we use in combination of quantitative and qualitative methods within a single study, the research allows for more complete analysis and better investigation. As a result, this section focused on the quantitative analysis which is the effect of an explanatory variable on the dependent variable in order to strengthen the qualitative analysis.

3.6. Regression Analysis

Undergoing statistical regression analysis is mandatory for the purpose of assessing the impact of one variable on the other variable. So, the research used multiple linear regression analysis in order to know the impact of the independent variable on the dependent variable taking institutional arrangement, informal settlement, public participation, the existence of investors, land availability, and unemployment as independent variables and development plan implementation as the dependent variable. Here is the result of regression models that examine the effect of independent variables on the dependent variable (Table 2).

Table 2. Coefficient of Regression Analysis

DPI	Coef.	Std. Err.	T	P>t	[95% Conf. Interval]	
IA	.1949058	.0529667	3.68	0.000	.0904057	.299406
IS	-.272826	.0379324	-7.19	0.000	-.3476643	-.1979876
PP	.2532955	.0376605	6.73	0.000	.1789936	.3275973
IV	.1508186	.0405537	3.72	0.000	.0708085	.2308287
LA	.173538	.0349572	4.96	0.000	.1045696	.2425064
UE	-.0556011	.028852	-1.93	0.056	-.1125243	.0013222
_cons	1.683752	.249905	6.74	0.000	1.190704	2.1768

Source: own survey STATA (2022)

Where: DPI = local development plan implementation, IA = institutional arrangement, IS = informal settlement, PP = public participation, IV = investor, LA = land affordability, UE unemployment, _cons = constant factor.

The regression model equation that estimates the value of implementation of town development plan based on observed values of independent variables can be stated as:

$Y=\beta0+\beta X1+\beta X2+\beta X3+\beta X4+\beta X5+\beta X6+\mu$

$Y=1.684+0.195X1-0.273X2+0.253X3+0.151X4+0.174X5-0.056X6+\mu$

In regression output, the coefficients of determination were used to replace the unknown beta (β) value of the regression model. Beta indicates the level of influence of each predictor variable on the dependent variable: as well as it indicates the direction of the relationship. The significance value (p-value) implies the statistical significance of the relationship. The significance value used in this study was 5% (0.05). The beta value also indicates the amount of change in the dependent variable due to a 1 unit change in independent variables, and finally, the constant term of the model indicates the value of the development plan implementation if all explanatory variables are held constant.

3.7. Discussion of the Inferential Analysis

The results of multiple linear regressions as illustrated in Table 2 revealed that institutional arrangement has a positive and statistically significant effect on development plan implementation with a beta value of 0.195 and a p-value of 0.000, which is less than 0.05. This implies that other explanatory variables remain constant if the mean score value of institutional arrangement increases by 1 unit, on average, the mean score value of development plan implementation increases by 0.195 units and is statistically significant at a 5% significance level. Based on this, the research accepts the first hypothesis that institutional arrangements had a significant effect on development plan implementation.

The results of multiple linear regressions as depicted in Table 2 above also showed that informal settlement had a negative and statistically significant effect on development plan implementation with a beta value of -0.273 and a p-value of 0.000, which is less than 0.05. This implies that, while other explanatory variables remain constant, if the mean score value of informal settlement increases by 1 unit, on average, the mean score value of development plan implementation decreases by -0.273 unit and is statistically significant at 5% significance level. With regard to this finding, the investigator accepts the hypothesis that informal settlement had a significant effect on development plan implementation.

The results of multiple linear regressions as presented in Table 2 revealed that, public participation had a positive and statistically significant effect on development plan implementation with a beta value of 0.253 and a p-value of 0.000, which is less than 0.05. This shows that, other explanatory variables remain constant if the mean score value of public participation increases by 1 unit; on average, the mean score value of development plan implementation increases by 0.253 units, which is significant at the 5% significance level. Based on this finding, the research accepts the research hypothesis that was formulated as public participation had a significant effect on development plan implementation.

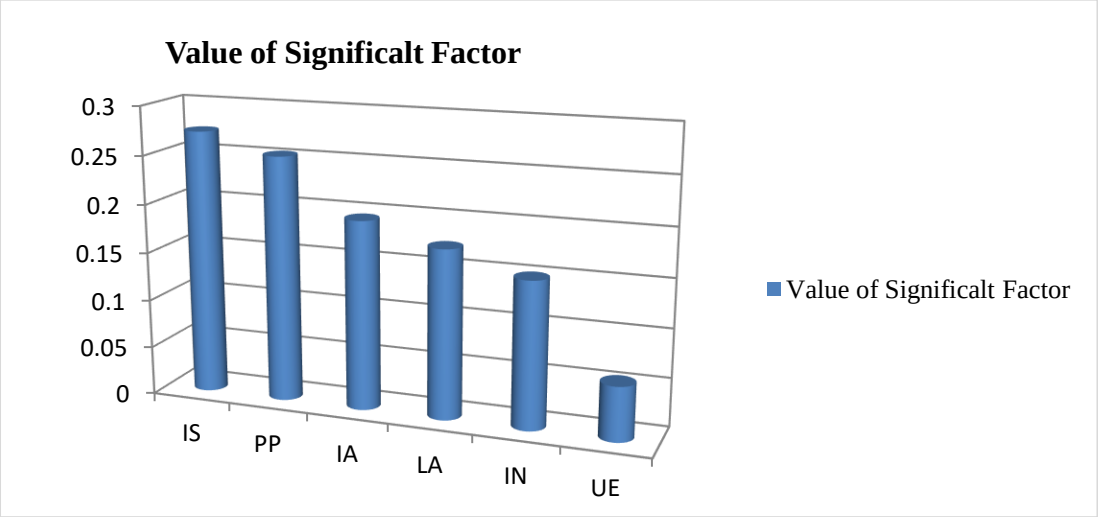
The results of multiple linear regression presented in Table 2 above indicated that the existence of investors had a positive and significant effect on development plan implementation with a beta value of 0.151 and a p-value of 0.000 which is less than 0.05. This shows that other explanatory variables remain constant if the mean score value of the investor increases by 1 unit; on average, the mean score value of development plan implementation increases by 0.151 units, which is significant at the 5% significance level. Hence, the findings of the study showed that investor has a significant effect on development plan implementation.

The research accepted the hypothesis that formulated investors had a significant effect on development plan implementation. The results of multiple linear regressions as presented in Table 2 revealed that, land supply has a positive and statistically significant effect on development plan implementation with a beta value of 0.174 and a p-value of 0.000, which is less than 0.05. This shows that, other explanatory variables remain constant if the mean score value of land availability increases by 1 unit; on average, the mean score value of development plan implementation increases by 0.174 unit, which is significant at the 5% significance level. Therefore, the findings of the study showed that land availability as a significant effect on development plan implementation; the research accepted the hypothesis that formulated land availability had a significant effect on development plan implementation.

The results of multiple linear regression as presented in Table 2 revealed that, unemployment has a negative but insignificant effect on development plan implementation with a beta value of -0.0556 and a p-value of 0.056 which is greater than 0.05. This shows that, other explanatory variables remain constant if the mean score value of unemployment increases by 1 unit, on average, the mean score value of development plan implementation decreases by -0.0556 unit, which is insignificant at the 5% significance level. Based on this finding, the research rejects the research hypothesis that formulated as unemployment, had a significant impact on development plan implementation.

In general, qualitative data could not tell us which variable had the most influence on the implementation of the municipal development plan. However, the inferential statistic could tell us which independent variable has the most influence on the successful and efficient implementation of the town development plan. As a result, based on quantitative or statistical data (regression analysis), the indication of which variable has a strong impact on the implementation of the development plan is presented below in Figure 1.

Figure 1. Value of significant factor



Source: own survey STATA (2022)

As described in the preceding qualitative section, the key constraints include the presence of informal settlement, inadequate institutional arrangements, a lack of effective public engagement, a scarcity of investors, a scarcity of land, a low standard of construction, and the prevalence of unemployment. However, it could not tell us which variable had the most influence on the effective implementation of a local development plan. As a result, the study employed inferential analysis to determine which variables had a significant impact on the effective implementation of a development plan. Therefore, according to Figure 1 or Table 2, based on the coefficient of significant factor produced from multiple regression analysis, the presence of informal settlement is the first main factor that impacts local development plan implementation to be incomplete in the claimed period of time. The absence of public participation and a weak institutional organization are the second and third significant factors affecting effective plan execution, respectively. The fourth, fifth, and sixth elements influencing development plan implementation are, in order, a scarcity of land, a scarcity of investors, and the predominance of unemployment. They have less of an impact on effective plan implementation, however, when compared to inadequate institutional arrangements, the presence of informal settlement, and the absence of public participation.

4. CONCLUSION

In light of the study's objectives, it was discovered that the most valuable resources for comprehensive town development and preparing new plans for the future are agricultural productivity, tourism, good rural-urban linkage, proximity to other towns, construction materials, and a good road network. The majority of respondents agreed that the main obstacles to the effective implementation of town development plans are a lack of institutional arrangements, the presence of informal settlements, a lack of public participation, a scarcity of land, the prevalence of unemployment, and a lack of investors. The regression results also supported this, indicating that strong institutional arrangements, public participation, land supply, and the presence of investors have a positive and statistically significant effect on the town's development plan implementation, while the presence of informal settlement has a negative and statistically significant effect. As a result, it is stated that the greatest hindrance to the efficient implementation of town development plans is the lack of public participation, insufficient institutional arrangements, the prevalence of informal settlements, a shortage of land, and a lack of investors. It was also clear that the majority of respondents agreed that the prevalence of massive unemployment in their town had an impact on development plan implementation, but the regression results revealed that, contrary to their agreement, the prevalence of unemployment

has an insignificant impact on development plan implementation. According to the findings, the presence of unemployment has no effect on the effective implementation of town development plans in the study area.

In short:

- Institutional arrangements have a positive and significant effect on LDP in Enewari town.
- Informal settlement has a negative and significant effect on LDP in Enewari town.
- Public participation has a positive and significant effect on LDP in Enewari town.
- Investor has a positive and significant effect on LDP in Enewari town.
- Land supply has a positive and significant effect on LDP in Enewari town.
- Unemployment has a negative and insignificant effect on LDP in Enewari town.

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COMPARATIVE ANALYSIS OF LEONARDO AI, MIDJOURNEY, AND DALL-E: AI'S PERSPECTIVE ON FUTURE CITIES

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ABSTRACT

This paper aims to deepen our understanding of the intricate role that Artificial Intelligence (AI) plays in the ever-changing landscape of urban design and planning, building on a seminal study conducted a year ago that utilized the Stable Diffusion 1.5 algorithm to investigate "AI's Vision of Future Cities". This Study, version 2.0, provides a comprehensive comparison and evaluation of three cutting-edge AI text-to-image generation algorithms: LeonardoAI, Midjourney and Dall-E with the same technique of the previous study. Using curated series of prompts that integrate a variety of crucial urban design themes, such as smart cities, sustainability, eco-design, biomimicry, and topology optimization, the study provides a nuanced evaluation of the unique capabilities, strengths, and limitations inherent in each of these advanced AI tools. In the findings, although LeonardoAI is proficient at providing a balanced thematic representation, it tends to produce less realistic images. Midjourney v5.2 is distinguished by its ability to generate visually striking yet exaggerated depictions of urban elements with variety. Dall-E 3 is the most usable and practical tool for generating clear and coherent urban elements, despite its logical limitations. The study concludes by emphasizing the context-dependence of the effective and meaningful application of AI tools in the multifaceted and complex domain of urban design. In addition, it argues that these AI tools are most effective when used in conjunction with conventional design and planning techniques. This research not only extends and elaborates on the previous study's findings, but it also explicit the visuality in rapid change of the AI image synthesis for the groundwork of future research avenues.

Keywords*: Artificial intelligence, urban design and planning, text-to-image generation, comparative analysis, image synthesis*

1. INTRODUCTION

The intersection of architecture, planning, and public policy, urban design influences the physical layout and organization of cities. As urban areas continue to expand and face increasingly complex challenges related to sustainability, mobility, and social equity, the importance of innovative technologies grows. The emergence of Artificial Intelligence (AI) as a transformative tool that offers novel ways to visualize, plan, and develop urban landscapes. Particularly, AI-generated imagery is a compelling medium for exploring and communicating complex urban design concepts, ranging from fundamental spatial arrangements to intricate sustainable ecosystems.

How do various AI tools—specifically LeonardoAI, and Midjourney, Dall-E—interpret and visualize future urban landscapes in response to a series of increasingly complex prompts is the central research question guiding this study. This question seeks to elucidate the capabilities and limitations of these AI-powered image generation tools that can inform and inspire urban design practices.

The objective of this research is to enhance our comprehension of the intricate role of AI within the constantly evolving field of urban design and planning. This study builds upon a previous investigation conducted one year ago, which employed the Stable Diffusion 1.5 (DiffusionBee) algorithm to explore the concept of "AI's Vision of Future Cities" [1]. Updated study employs a comparative analysis methodology, utilizing three AI tools—Dall-E, LeonardoAI, and

Midjourney—to generate significantly improved visual representations in response to a set of predefined prompts.

This study employs a comparative analysis approach to examine three AI tools that have gained prominence in the field of text-to-image generation: LeonardoAI (Leonardo Diffusion XL - Leonardo Style), and Midjourney V5.2, Dall-E 3. The selection of these tools was based on their exceptional capabilities, widespread application, and relevance to the acceptability in the field of urban design and planning.

The research employs a set of six predefined prompts intended to investigate varying conceptual complexities of future urban landscapes. These prompts range from the simple "Create an image of a future city" to the more nuanced and complex "Create an image of a future city, smart city, sustainability, eco-design, biomimicry, topology optimization." The design of these prompts is intended to elicit AI-generated images that can inform and inspire urban design practices, particularly in the context of recent urban design terms.

In order to collect data, each of the selected AI tools were used to generate images in response to predefined prompts. Each tool was utilized to generate multiple images for each prompt, which were then catalogued and discussed. The generated images were analyzed through a lens with multiple dimensions. First, the aesthetic qualities of the images, including visual appeal, photorealistic perception and composition were evaluated. Second, the functional attributes were assessed with a focus on how well the images aligned with principles of the inputted prompts about urban design. A comparative evaluation of the relative strengths and weaknesses of each tool for generating contextually relevant and suitable design solutions was then conducted.

2. LITERATURE REVIEW

Academic discourse has been devoted to the implications of AI in spatial design with the 90's. Ivezic and Garret present a simulation-based decision support system (SB-DSS) for early collaborative design processes, utilizing machine learning in design [2]. The system consists of four components: behavior-evaluation model, probabilistic framework, statistical neural network approach, and Monte Carlo simulation. Experimental evaluations show promising results, and the machine learning approach is categorized in a very early stage of AI in design.

2.1 AI and Spatial Design Education

Scianname, who explored the role of machine learning algorithms in design conceptualization within spatial design courses, conducted one of the recent pioneering studies in this field [3]. The study found that AI tools could help students generate initial design concepts, thereby speeding up the iterative design process. In the various stages of design education, the research reveals the potential for AI as a facilitating tool. Dai and Ke investigated how AI could be utilized in simulation-based design tasks. Their research employed AI algorithms to simulate various environmental conditions, allowing students to test and refine their designs [4].

The incorporation of AI into spatial design education signifies a paradigm shift in educational pedagogy. As spatial design encompasses numerous disciplines, such as architecture, urban planning, and interior design, the potential applications of AI are similarly diverse [5–10].

2.2 AI Driven Sustainability in Urban Design and Planning

The advent of AI has introduced a new era of urban design possibilities. AI technologies provide innovative solutions to these multifaceted problems, which range from population density to environmental sustainability, as cities face complex challenges such as these concepts [11].

Data analytics and simulation represent two of the most promising applications of AI in this field. Guo et al. investigated how machine learning algorithms could be used to analyze traffic patterns, thereby contributing to the development of more efficient transportation systems [12]. Their research demonstrated that AI could not only predict traffic flows, but also recommend optimal routes, thereby reducing carbon emissions and enhancing urban mobility.

Environmental sustainability is yet another significant application area. Significant studies investigated the role of AI in optimizing urban green spaces. Using AI algorithms, they were able to determine the optimal locations for parks and greenbelts [13–16]. Their findings indicate that AI can play a crucial role in the development of more sustainable and livable urban environments.

It is important to note, however, that the application of AI to urban design is not without obstacles. Ethical concerns, such as data privacy and algorithmic bias, have been cited as potential disadvantages [17–19]. Other critical study explores the potential impacts of AI on urban planning, aiming to create a typology of urban planning [20]. It categorizes AI in planning from AI-assisted and augmented to AI-automated and eventually AI-autonomized, based on a scoping literature review. The paper aims to address unanswered questions and provide appropriate responses and plans in the AI-enabled planning process.

The most related work for this study investigates the capabilities and biases of text-to-image methods in the built environment [21]. Using a systematic grammar, 1020 images related to the built environment are generated. The results show that text-to-image transformers are robust in generating realistic images across different domains.

2.4 Comparatives of Text-to-Image AI Tools

The expanding field of text-to-image generation has spawned a variety of AI tools, each with its own capabilities and limitations. Comparisons of the tools are focuses on various context like the imagery and the semantic relations of the created images [22–26], or more specific areas like examining the accuracy of three AI text-to-image generators, Dall-E 2, Midjourney, and Stable Diffusion, in representing the medical profession's demographic realities [27]. Nevertheless, comparative analyses of these tools, particularly in the context of spatial and urban design, are rare in the existing literature [28].

Generative adversarial networks have revolutionized the field of text-to-image synthesis, enhancing visual realism, diversity, and semantic alignment. However, challenges remain, including high-resolution images and reliable evaluation metrics. A review contextualizes the state of adversarial text-to-image synthesis models, proposes a taxonomy, and examines evaluation strategies [29]. It suggests new areas for research, including better datasets, evaluation metrics, and architectural design improvements.

While these studies provide a basis for comprehending the comparative performance of text-to-image AI tools, they frequently lack an emphasis on spatial and urban design applications [30]. This gap in the literature highlights the need for comparative studies that evaluate the utility of these tools in generating images that are not only visually compelling but also contextually relevant to the field of design.

2.5 Vacancies in the Literature

Existing literature provides valuable insights into the individual domains of AI in urban design, spatial design education, comparative analyses of AI tools, and sustainable urban planning; however, there are notable gaps that merit further study.

First, the comparative analysis of text-to-image AI tools in the context of spatial and urban design is a largely unexplored field. There are studies that compare the performance of AI tools, but they typically focus on technical or artistic aspects and lack a focused examination of their utility in generating contextually relevant and sustainable design solutions [10,20].

Second, while the role of AI in sustainable urban planning has been discussed, it is typically limited to specific applications such as energy optimization [31,32]. The potential contribution of AI-generated imagery to broader sustainable urban planning strategies has not been exhaustively examined.

In conclusion, the rapid development of AI technologies necessitates ongoing research to keep up with the changing environment. Newer versions of AI tools, such as Dall-E 3, LeonardoAI, and Midjourney V5.2, include enhanced features that have not been thoroughly evaluated in an academic setting.

3. COMPARATIVE ASSESSMENT

3.1 Prompt 1 - "Create an image of a future city."

The first prompt is an investigation into the fundamental capabilities of each AI tool in rendering an image of a future urban landscape. The subsequent analysis evaluates the images based on their aesthetic and functional characteristics, as well as their congruence with overarching futuristic urban design themes.

LeonardoAI

Through the urban environment, LeonardoAI generates images in which water permeates (Fig. 1). Urban green elements are predominantly situated at ground level, while bridges provide support for the circulation. The images exhibit a dense collection of high-rise structures. The differentiation between the images that are strictly lack of photorealism and computationally generated is instantaneously apparent.

Fig. 1. The images generated by LeonardoAI in response to the prompt "Create an image of future city".

Midjourney

The water element is prominently featured in images produced by Midjourney, commanding immediate attention similar to LeonardoAI (Fig. 2). In the images, indications of transportation via water are apparent. Consistent with prior observations, the green component is primarily situated at ground level across all images.

Fig. 2. The images generated by Midjourney in response to the prompt "Create an image of future city".

Dall-E

The variety of images produced by Dall-E is extraordinary (Fig. 3). Dall-E's images depict unique settings, as opposed to the visuals generated by the preceding two platforms, which tended to exhibit similarities within their compositions. The first depicts a city dominated by green textures, whereas the second features structures arranged around a nearly axial watercourse. The third image portrays the emergence of structures within a desolate world environment reminiscent

of a desert terrain. The fourth image depicts terraced green structures tucked away on the incline of a mountain, distinguished by the imitation of manual drawing/painting methods.

Fig. 3. The images generated by Dall-E 3 in response to the prompt "Create an image of future city".

3.2 Prompt 2: "Create an image of a future city, a smart city."

The second prompt aims to delve deeper into the capabilities of each AI tool by introducing the concept of a "smart city", adding another layer of complexity to the generated images. The images are evaluated based on their esthetic and functional qualities, as well as their conformity with smart city principles.

LeonardoAI

The image generated by LeonardoAI in response to this prompt depicted a cityscape replete with technological advances (Fig. 4), such as air vehicles and airborne infrastructure, especially in the second image. The second image also incorporated elements of green rooftops and the fourth image depicts solar panels with the lack of photo-realism.

Fig. 4. The images generated by LeonardoAI in response to the prompt "Create an image of future city, a smart city".

Midjourney

Compared to its previous output, Midjourney's image for this prompt was more abstract, featuring a complex network of interconnected nodes and curves, possibly representing data flows or smart grids (Fig. 5). The transparency of the building is significant. While visually captivating, the images' abstract nature made them effective at conveying the concept of a smart city.

Fig. 5. The images generated by Midjourney in response to the prompt "Create an image of future city, a smart city".

Dall-E

The images of Dall-E featured a city with futuristic architecture with holographic context and advanced transportation systems, such as flying cars and drones and with an odd sharing of the rail and automobile systems (Fig. 6). Also, the image has iconographic pictogram indicators of the incorporation of smart technologies, such as sensors or data centers, making it compatible with the smart city concept. This is due to the fact that the training images of the smart city concepts are heavily depicted with these kinds of pictograms.

Fig. 6. The images generated by Dall-E 3 in response to the prompt "Create an image of future city, a smart city".

3.3 Prompt 3 - "Create an image of a future city, a smart city, sustainability."

The third prompt introduces the concept of sustainability and aims to evaluate how well each AI tool can incorporate this crucial element into its generated images of a future smart city. The images are evaluated based on their aesthetic appeal, functional characteristics, and conformity with smart city and sustainability principles.

LeonardoAI

One could argue that the visuals produced by LeonardoAI exhibit a slight increase in the number of green areas, thus reflecting the concept of sustainability (Fig. 7), in comparison to its previous iterations. With a specific emphasis on the second image, elevated prevalence of dome-shaped structures are observed, while both the second and third images depict the urban environments of an island.

Fig. 7. The images generated by LeonardoAI in response to the prompt "Create an image of future city, a smart city, sustainability".

Midjourney

A substantial amount of flora has been incorporated due to the utilization of the term "sustainability" in the visuals of Midjourney (Fig. 8). The green texture extends upwards onto the structures as well as exists at ground level. Other than the second image, structures that are surreal and spatially impractical are visible in every image but the fourth.

Fig. 8. The images generated by Midjourney in response to the prompt "Create an image of future city, a smart city, sustainability".

Dall-E

In terms of green diversity, Dall-E has expanded since the inclusion of the term sustainability (Fig. 9). The sustainability aspects are rigorously incorporated into the designed visuals, which encompass wind turbines, rooftop gardens and greenhouses, green terraces situated between floors of high-rise buildings, and terraced fields that cascade throughout the urban landscape.

Fig. 9. The images generated by Dall-E 3 in response to the prompt "Create an image of future city, a smart city, sustainability".

3.4 Prompt 4 - "Create an image of a future city, a smart city, sustainability, eco-design."

The fourth prompt introduces "eco-design" as an additional thematic layer, evaluating each AI tool's ability to produce images that not only incorporate smart technologies and sustainability, but also adhere to the principles of ecological design elements.

LeonardoAI

The majority of the images produced by LeonardoAI resemble an island city in physical appearance (Fig. 10). Unexpectedly, the term "Eco-Design" has not yielded substantial alterations in contrast to the visuals presented in the preceding section. It is noteworthy that an accumulation of elevated roadways can be observed in the images.

Fig. 10. The images generated by LeonardoAI in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design".

Midjourney

The conceptual image created by Midjourney in response to this prompt depicted a network of interconnected green spaces and what appeared to be a utopist and dreamy cityscapes (Fig. 11). Interestingly, the presence of aerial vehicles is observed in all images except the third, and airborne structures are noticeable in the fourth image.

Fig. 11. The images generated by Midjourney in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design".

Dall-E

The appearance of Dall-E 3 was visually appealing, and it executed near perfectly the eco-design elements (Fig. 12). The image depicted futuristic architecture and advanced transportation systems, it shows various and clear indicators of ecological design principles, such as the use of renewable building energy sources and natural water management systems with cascades.

Fig. 12. The images generated by Dall-E 3 in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design".

3.5 Prompt 5 - "Create an image of a future city, a smart city, sustainability, eco-design, biomimicry."

The fifth prompt adds "biomimicry" as an additional thematic layer in order to assess the capability of each AI tool to generate images that not only adhere to the principles of smart cities, sustainability, and eco-design, but also incorporate elements inspired by natural systems.

LeonardoAI

Although the concept of biomimicry is notably manifested in architectural structures, the transportation infrastructure has not undergone substantial transformation (Fig. 13). Certain architectural designs manifest the impact of biomimicry through the adoption of highly curved geometries and nearly inconceivable forms.

Fig. 13. The images generated by LeonardoAI in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry".

Midjourney

The image created by Midjourney in response to this prompt was particularly comprehensive, depicting a cityscape that incorporated biomimetic design principles, such as building structures inspired by natural forms (Fig. 14). The image effectively communicated a holistic vision of a future city that is intelligent, ecologically designed, biomimetic, and sustainable.

Fig. 14. The images generated by Midjourney in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry".

Dall-E

The visual representation of Dall-E 3 was aesthetically pleasing and effectively incorporated biomimetic features, including honeycomb and delenuay structures (Fig. 15). Green architecture featuring curvilinear meshes and vegetated terraces. Biomimicry contributes to the creation of more intriguing forms, particularly in the initial and subsequent images. A distinctive graphical

pictogram is superimposed on the upper portion of the second image. In addition, natural areas are conspicuously divided from cubical settlements by a rail system.

Fig. 15. The images generated by Dall-E 3 in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry".

3.6 Prompt 6 - "Create an image of a future city, a smart city, sustainability, eco-design, biomimicry, topology optimization."

The sixth and final prompt adds "topology optimization" as an additional form dependent layer to assess the ability of each AI tool to produce images that adhere to the principles of future cities.

LeonardoAI

The image submitted by LeonardoAI in response to this prompt was particularly intricate, incorporating biomimetic design, and structures that appeared to be optimized for material efficiency and structural integrity due to the topology optimization prompt (Fig. 16).

Fig. 16. The images generated by LeonardoAI in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry, topology optimization".

Midjourney

The images submitted by Midjourney for this prompt depicted a network of interconnected green spaces, smart grids, biomimetic elements, and topologically optimized structures (Fig. 17). The diversity of the structures and the environmental elements are rich in this stage.

Fig. 17. The images generated by Midjourney in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry, topology optimization".

Dall-E

The visual representations produced by Dall-E 3 exhibit advanced transportation systems and futuristic architecture, offering distinct indications of structures that have been optimized, such as material-efficient bridges and buildings (Fig. 18). The initial image showcases an innovative and carefully constructed transportation strategy. The buildings in the first and second images exhibit a slight resemblance to Voronoi diagrams in their topology optimization through the use of biological forms. Honeycomb structures comprise the third image's composition. On the contrary, the fourth image exhibits no indication of topology optimization.

Fig. 18. The images generated by Dall-E 3 in response to the prompt "Create an image of future city, a smart city, sustainability, eco-design, biomimicry, topology optimization".

4. COMPREHENSIVE EVALUATION OF TEXT-TO-IMAGE ALGORITHMS

Several notable observations arise as a recurring theme among the synthesized images. The water element consistently plays a crucial role in a wide range of visuals, exerting a significant influence on various aspects of the compositions. The depiction of aerial vehicles as essential components of forthcoming transportation systems conveys a progressive and future-oriented perspective. Moreover, the intentional examination and creation of sophisticated transportation arrangements emerge as a prominent emphasis in these visual representations, illustrating a dedicated endeavor to conceive inventive solutions for urban mobility. Additionally, the abundance of tall buildings depicted in the majority of the images corresponds to the expected urban skyline of a futuristic metropolis. It is important to highlight that the configuration of tall buildings in the urban landscape exemplifies a sparse development approach near green areas, which bears resemblance to the early architectural manifestos of Le Corbusier. This is in opposition to the more compact configurations that Le Corbusier subsequently boasted after his observation of Manhattan.

4.1 LeonardoAI

LeonardoAI is distinguished by its mild approach to image generation, which integrates smart technology, sustainability, eco-design, biomimicry, and topology optimization with unsuccessful photorealisticity. However, one area where LeonardoAI's output could be improved is in its depiction of road networks, which appear fuzzier and less distinct. This lack of clarity in transportation infrastructure could compromise its usefulness in urban design applications requiring precise detailing.

4.2 Midjourney

Midjourney V5.2 provides a novel, conceptual approach to image generation, frequently generating exaggerated depictions of urban landscapes. Similar to LeonardoAI, Midjourney depicts road networks with fuzziness in its images. Although the tool's abstract nature can be visually appealing, the lack of clarity in essential urban elements may limit its applicability in urban design scenarios that require explicit representation.

4.3 Dall-E

Dall-E 3 excels at producing visually variated images, outperforms the competition in the delineation of road networks, and present more accurate image synthesis which are more precisely defined as other studies [21,33,34]. However, this clarity comes at the expense of continuity, as evidenced by the abrupt transitions between trainways and highways, especially at elevated junctions. Such inconsistencies may present difficulties for applications requiring a coherent and integrated transportation network.

4.4 Optimal Tool Evaluation

The comparative analysis reveals that the selection of the "optimal" AI tool is contingent on the project's particular objectives and criteria. LeonardoAI lacks of realism but depicts more defined geometry in buildings, Midjourney provides a well-balanced but exaggerated depiction of various urban design themes, but falls short when it comes to logical network precision. Dall-E excels in the clarity of such urban elements, and its thematic depth is rich. Therefore, the "best" tool is not a one-size-fits-all solution, but rather depends on the project's specific requirements. This evaluation encourages urban designers to view AI tools as adaptable instruments that can be tailored to specific design objectives.

In terms of comprehensive evaluation, DALL-E exhibits a marginal advantage in performance. The software's ability to generate a wide variety of images, including intricate transportation systems and futuristic architectural designs, demonstrates its remarkable versatility. Furthermore, the comprehensive examination of sustainability principles, albeit with variations in execution across images, highlights DALL-E's ability to portray intricate and pioneering urban situations. DALL-E emerges as a prominent contender among the analyzed AI text-to-image generative platforms due to its nuanced superiority.

5. CONCLUSION AND FUTURE RESEARCH

The study suggests that AI should be viewed as a complement to conventional design methods, particularly useful in the early design stages for rapid ideation and exploration of multiple scenarios.

Future research could concentrate on the creation of hybrid design methodologies that combine AI-generated imagery with conventional design processes. The investigation of how AI algorithms can be trained to better comprehend and incorporate urban design principles and guidelines is a further avenue to pursue [35].

This study investigates the uncharted territory of AI-augmented urban design at the cusp of a new era in which AI is poised to redefine multiple facets of human endeavor. While the AI tools analyzed in this study provide tantalizing glimpses of future possibilities, they also serve as cautionary tales, reminding us that technology is merely a tool whose effectiveness is contingent on the hands that wield it. Could AI's data-driven approach perpetuate existing urban inequalities or even generate new forms of spatial injustice? As we progress, the challenge is not only to advance the technical capabilities of AI, but also to align these advancements with ethical considerations and societal requirements [36].

AI can serve as both a compass and a mirror in the labyrinthine journey of urban design: a compass that guides us through complex design challenges, and a mirror that reflects our aspirations, limitations, and choices. As we continue to navigate this complex maze, let's use AI as a dynamic canvas that invites us to co-create more creative.

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