Tackling Uncertainties of Design Projects

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Abstract: Urban planning and design projects face several uncertainties; in Iran, these uncertainties are intensified due to continuous changes in the planning and design context. Design context uncertainties are diverse, such as administrative, legal, informational, and even physical. The number of uncertainties increases when the scale of the projects increases. This article reviews the design challenges of a large-scale project in Tehran, Iran and proposes a design framework, derived from practical design experience, to tackle these challenges. Four hundred hectares of land suffer from several environmental and ownership issues. The land adjacent to a watercourse has been used for sand and gravel exploitation for decades. The area beside the watercourse has been excavated over time, and the land level has dropped nearly ninety meters below the watercourse bed. The municipality has treated the subject in various ways, from neglecting the issue to forcing the project designers to follow specific processes. Moreover, the project is the place of several conflicts between landowners. This paper discusses the weaknesses of typical urban design process frameworks to respond to design problems. A new urban design framework is proposed. The Incremental process of Urban Design (IPUD) is proposed to tackle the problem. Borrowed from the idea of Disjointed Incrementalism by Lindblom and inspired from the morphological transformation of urban form, it is claimed that the idea of incremental physical change can respond to the diversity of contextual uncertainties in urban design projects. The IUPD tackles the changing circumstances of large-scale projects starting from small-scale pilot projects accompanied by a vague preliminary idea whose development can serve as the design vision. The plan can grow from these pilot projects and connection rules with an incremental approach and provide varying feedback and growing understandings of context to develop next-step sub-projects and transform the preliminary idea into a more concrete design vision.

Keywords: Urban Design Process, Urban Morphology, Design Uncertainties, Incremental Urban Design Process, Incrementalism.

Introduction

The urban design process is assumed to guarantee the urban design product, the designed plan. The evidence of this guarantee can be sought in the result of its implementation. As the scale of the project increases, the realisation time lag also increases. Lang (2005) introduces projects whose implementation process has been prolonged for nearly twenty years. Clark Quay in Singapore (seventeen years), Barbican in London (twenty years), and Raleigh Park in Sydney (eighteen years) can be named as a few examples. Lang mentions changes in and "uncertainties" of the context (as a general term) as the causes of most of these time lags. Changes in the context, rights, stakeholder groups, and data sometimes leads to what Talen (1996) calls the "new plan syndrome".

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Implementing large-scale design projects as a whole suffers from problems resulting in the uncertainty of context and rigidity of urban plans. The plan for La Defence in Paris started in 1920 and changed several times during the World Wars, and what we see on earth today is a result of what Giscard d'Estaing suggested in 1971 (Lang, 2005). Institutional barriers (changes and inertia) puts pressure on the realisation of projects (Bahrainy & Azizkhani, 2012). The need for detailed data for design doubles the uncertainty, mainly in countries with a weak mechanism for accessibility to data (Alnsour & Meaton, 2009; Liu *et al.*, 2010). In developed countries, this happens when the aim is to use a contemporary concept or method, like sustainability, in the design process (William & Dair, 2007).

In the history of urban design and planning, there are straightforward critiques of Master Plan design, whose rigorous approach fails in the dynamic context of urban environments. Alternatives have been suggested as design processes, such as by Alexander (1979), Duany & Plater-Zyberg (2002), and Garcia & Lydon (2015). However, these methods must address large-scale projects facing various uncertain conditions.

This article reviews the design process for an urban site in Tehran, Iran, to clarify the complexity of the uncertainties that a megaproject faces and to search for a practical solution to tackle the uncertainties of it.

1. Assessing the Organisational Plan of the Kan Creek and its Southern Lands[2], Tehran, Iran.

The study area is located in District 18, southwest of Tehran. These lands are considered to be the concrete western and southern edges of the city (Figure 1). The area of this case study is about 408 hectares covered by sand and gravel mines adjacent to a creek named Kan. Kan Creek is one of the seven creeks which flow down from the Alborz Mountains north of the City. The study area can be divided into four parts: the Kan Creek, the sand and gravel mining companies administrative buildings, the agricultural and horticultural lands and a vast pit resulting from removal of sand and gravel. Currently, 8.5% of the land area is allocated to the river and adjacent lands, 22.2% to administrative areas, 42.7% to sand and gravel mines removal pit, and 26.6% to agricultural and orchard lands (Figure 2).

The study area is adjacent to Kan Creek, in the southernmost part of the urban tissue through which the canal passes. Therefore, water runs through this area under heavily polluted conditions and enters the agricultural fields. The end of the urban fabric on the one side, and the proximity to natural areas and agricultural fields on the other provides the opportunity to take advantage of both artificial and natural environmental conditions in the development plan.

In the southern lands of Kan Creek, the extraction of sand and gravel from mines located in the study area over the past fifty years has created massive pits with an area of approximately 100 hectares and a depth of up to 90 meters (Figure 3). These sand and gravel mines and the resulting pits from the extraction have caused a north-south rupture in the urban fabric of District 18, and have created social and environmental damage that significantly affects the living quality of the area. The pits are also in full view of travellers who enter Tehran through the international airport (also located in the southwest).

Despite the location of the study area at the entrance of the city gate and its proximity to Kan Creek, which plays a significant role in the natural structure of the City, the revival of this urban environment has become a social, environmental, and physical necessity. By cre-

2. Here used as a translation for the Persian word "arazi" or "zamin" which can mean "earth" and "plots" at the same time. It is used for extra-large vacant, industrial or agriculture areas.

Figure 1. *Location of the Study area in Tehran, Iran. Author's elaboration (Abaee, 2018).*

Figure 2. *Distribution of natural landforms and sinkholes in the study area. Author's elaboration (Abaee, 2018).*

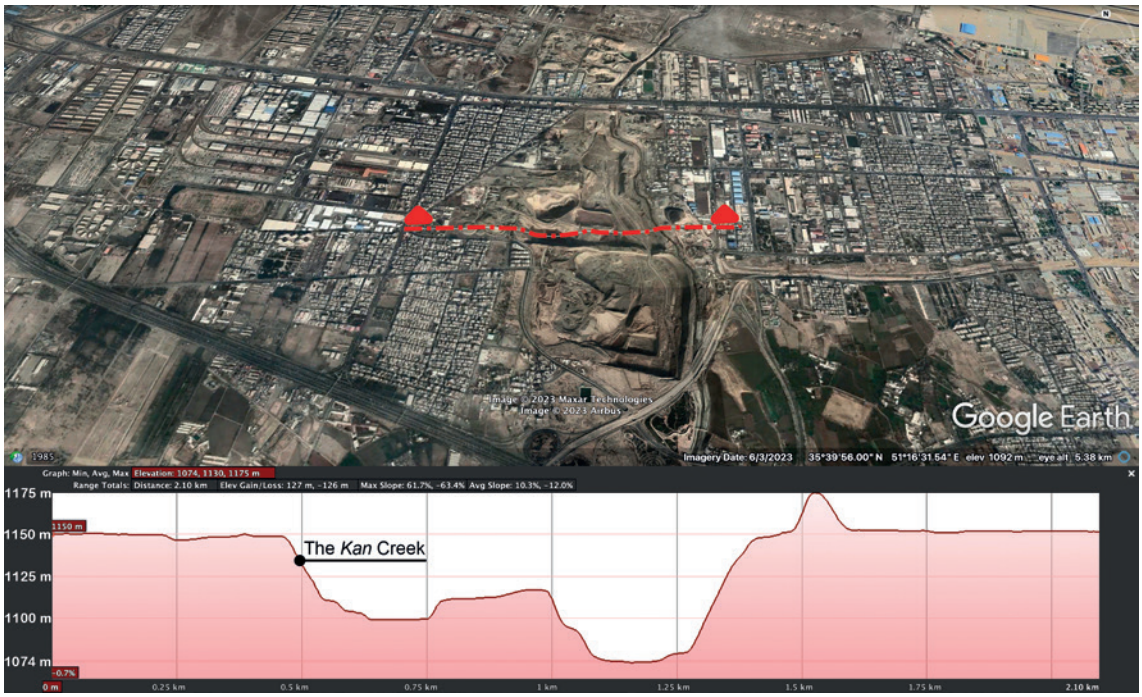

Figure 3. *Topographic section of the excavated pits within the study area (Google Earth Pro, 2023).*

ating a sustainable environment, the cohesion of the urban fabric had to be ensured and human damage to the environment should be avoided; at the same time, some of the shortages in services and tourism needed to be met, and a suitable and worthy view had to be provided at the entrance to Tehran. The existence of large properties with considerable areas and the willingness of owners to participate in urban management is an important factor towards achieving the objectives of the organisational plan.

2. Proposed Organisational Plan of the Kan Creek and its Southern Lands

The Kan Creek and its southern lands project can be explained in three stages.

The first stage involves the definition of the project and the formation of a participatory institution. In the late 2000s, one of the owners of sand and gravel factories in the study area decided to develop a project for their land north of the Fath expressway and a portion of the Creek's southern lands. The project aimed to prepare the land for constructing a residential complex. Upon the owner's request to the Gozineh Company as a consultancy, the consultant prepares a feasibility report that criticises the profitability of the residential construction project for the northern area of the Fath expressway. Instead, the consultant suggests that the owner partner with other landowners of the southern lands of Kan Creek and develop an initial plan for a mixed-use complex on that land. By doing so, not only will the owner benefit from the profits generated by these lands, but the value of residential properties in the northern area will also increase, leading to a more booming construction sector in the northern region. Based on this, a participatory institution, consisting of all the landowners, was formed to realise an organisational plan with a mixed-use function on a total area of 408 hectares in the southern lands of the Kan Creek, located below the Fath expressway. The cooperative company formed by the landowners was named "TAKA" (tose-ye arazi-ye kan-e Iranian), which translates to "Iranian Kan Creek's Land Development Cooperative".

The second stage involves preparing an integrated plan and its implementation challenges. After the contract was signed, the land project was developed within four years, forming a cultural and mixed-use centre. The aforementioned project was communicated to the implementing authorities through the approval of the Article 5 Commission (an administrative commission for jurying due diligence, changes in the city's detailed plan and planning large-scale projects) and was considered necessary for implementation. During the approval process of this project, the comprehensive and detailed Master Plan of Tehran was also approved, which envisioned cultural activities with an emphasis on green spaces and open areas for the southern lands of Kan Creek under the S222 Zone. Based on this, the project was considered to have inconsistencies with higher-level documents of Tehran. On the other hand, it faced implementation challenges related to its internal conditions and specifications. Due to the requirement for integrated construction based on owner partnership, the project demanded significant financial resources and an extensive implementation period, making execution impractical.

The third stage involves entering the decentralised and gradual progress phase, in which the concept, besides the upcoming issues, tries to respond to the practical failure of the previous step. Based on this, the participatory institution of the owners, "TAKA", and their consultants decided to reconsider the aforementioned project within the framework of the approved zoning and the feasibility requirements, relying on a reassessment based on the commission's decision. This proposal was accepted, suggesting that the project should be realised not through a unified development but through the diverse ownerships existing on the land. In this regard, each owner can develop a project within the limits of their allocated share from the approved land use plan. Therefore, the project is divided from a unified development into smaller-scale projects, allowing for an accelerated implementation process.

3. Integrated Project of the Kan Creek and its Southern Lands

Before preparing the organisational plan for Kan Creek and its southern lands, mine owners faced difficulties and were forced to halt their activities in the sand and gravel mines. Some of these problems included: i) the Department of Environment (DoE) demanded the suspension of mining activities to mitigate their negative impact on the surrounding environment; ii) the mines had reached their maximum extraction depth limit.

The initial approach to tackle the issue of halting mining activities and those of related factories was to fill the excavated pits with construction debris in exchange for a fee per truckload of debris. However, this method reduced the revenue generated from these mines and turned the location into a landfill for years, creating an unsightly view within residential areas. Furthermore, this inappropriate scenery was formed at one of the main entry points to Tehran. In 2005, after recognising the negative consequences of the approach mentioned above, the consulting engineers of the Gozineh Company introduced an alternative approach. This approach aimed to transform these mines into a mixed-use, tourism, recreational, and green space complex. By considering the characteristics of the location, it aimed to reduce the gap between residential areas and create a suitable entrance for Tehran. The claim was that by aligning stakeholders' interests, a win-win scenario could be achieved through this approach.

One aspect of the integrated plan has been to envision the role of the project area as a gateway due to the location of the lands in the southwest entrance of Tehran. This gateway is located near one of Tehran's main structure linear zones and tourist routes. Additionally, it serves as the primary entry point for the majority of travellers arriving from the international airport in Tehran. Therefore, among the proposed uses of the comprehensive plan, greater importance is placed on providing public service related to accommodation, hospitality, and large-scale open spaces for population settlement during times of crisis, compared to public services related to passenger transportation and cargo. However, it is essential to consider the significance of the entrance landscape and its visual appeal to the City of Tehran. Therefore, the project consultants have considered transforming this centre into a regional or even national tourism transportation hub to strengthen the spatial organisation of the overall city network.

Furthermore, in the detailed plan of District 18, a unique position has been designed for the project area in the region's development pattern and spatial organisation. This plan expects the studied project to not only reduce the gap between the eastern and western fabric of the area but also positively impact elevating the position of District 18 in the metroplitan city of Tehran. It aims to achieve this by creating a touristic and recreational environment with an appropriate landscape, serving as one of the main entrances to Tehran, and establishing regional activities within it.

Within the project's scope, the designated area comprising quarries, platforms, upper levels of sand and gravel mines, the Kan Creek, and adjacent lands in District 18 of Tehran forms a sustainable complex encompassing the natural, built, social, and urban environment. The project aims to harmonise economic objectives with other goals while ensuring environmental, artificial, social, and urban sustainability.

The defined visions for the project are classified into three categories: residential areas, industrial zones, and agricultural lands, based on their characteristics and functions (Figure 4 and Figure 5). The claim is that these visions, through environmental refinement and adaption to project conditions, responding to environmental requirements, harmonise the features of this ecological urban complex. Accordingly, the standards of the residential areas will be aligned with the environmental approaches, promoting eco-friendly practices. The industrial zones will undergo environmental refinement and transformation into factories

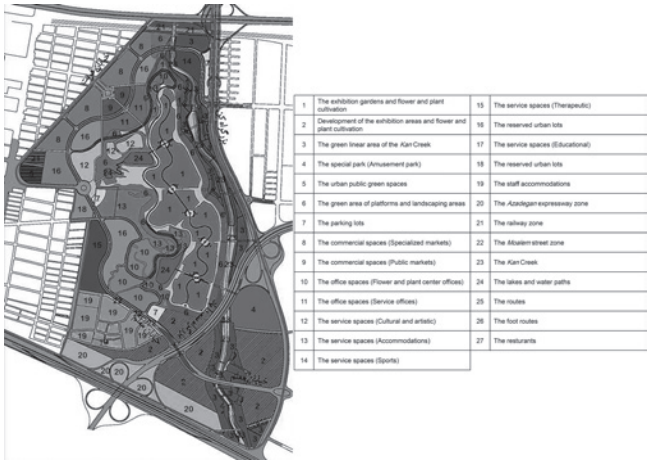

Figure 4. *Site plan of the integrated proposed design. Author's elaboration (Abaee, 2018).*

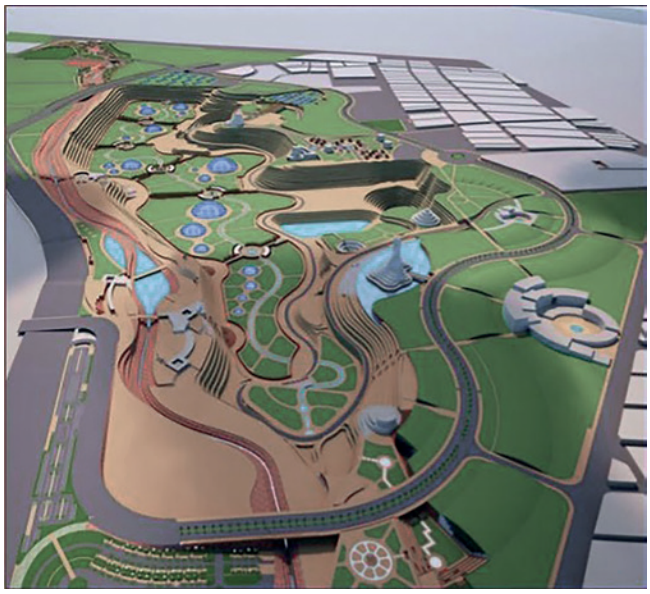

Figure 5. *Three-dimensional visualization of the proposed design, viewed from north to south. Author's elaboration (Abaee, 2018).*

that align with the green objectives of the project, both in terms of operational and construction technologies. The agricultural lands will also undergo improvement and preservation of green spaces, with proposals that ensure added value and economic justification following the planning and design approaches of the project area.

Based on the physical characteristics of the project site and in line with the proposed objectives, missions, and strategies in the planning studies, the project area has been divided into five different sections:

i. The Kan Creek and its surrounding lands: This area has been proposed to be transformed into a linear park along the Kan Creek.
ii. The sand and gravel mines: These areas have been allocated to productive and exhibition gardens for flowers and plants in the proposed plan.
iii. The platforms of sand and gravel mines and their upstream lands: The proposed plan for these lands includes commercial, administrative, and service-oriented uses, which not only meet the environmental needs of the area but also accommodate seven main activities within them. These uses operate at regional, sub-regional, and neighbourhood scales, encompassing markets, service offices, residential and hotel accommodations; headquarters for the exhibition gardens for flowers and plants, cultural and artistic centres, tourism, sports, and specialised medical facilities.
iv. The agricultural land and orchards: This land in the proposed plan is allocated to the development of productive flower and plant gardens in line with the anticipated activities in the sand and gravel mines.

v. The residential areas: This area currently has residential land uses, and its environmental quality is low, as indicated in the detailed plan with code R112, which allows residential buildings up to three stories. The plan for organising the land adjacent to Kan Creek assigns residential land uses with the R112 code to these lands. These areas can meet part of the housing needs of the special plan's employees. To ensure coordination and harmonisation of the physical environment of this complex with the objectives of the special plan, implementing quality control methods in construction within this area is necessary.

4. Gradual Project of the Kan Creek and its Southern Lands

The gradual approach to the design of the Kan Creek and its southern lands, based on the obstacles to the realisation of the integrated plan, has been presented and is currently being implemented. However, the integrated plan has been temporarily halted in the initial stages of its implementation process. The main factors contributing to the non-realisation of the project are related to ownership issues, the high volume of construction, and the challenge of attracting investments. Therefore, the project area has been divided into four different sections:

i. The Kan Creek zone: This zone extends from north to south and is defined under zone G of the comprehensive plan for the surroundings of the river.
ii. The large valley zone: This zone encompasses multiple land depressions and is characterised by a specific type of activity based on the geomorphological changes of the land.
iii. The urban zone: This zone is located adjacent to the western administrative buildings on the land.
iv. The urban-natural zone. This is a transitional zone between the urban fabric and the immense valley zones. It is an intermediate between these zones, acting as a buffer or threshold area.

Based on these four zones and ownership lines, efforts have been made to enable each owner to develop projects within their own property boundaries without needing land consolidation, while still obtaining the necessary permits for construction and operation. This type of project classification has brought the physical structure of the western region closer to the surrounding residential areas.

5. Discussion: Seeking an Alternative Process? Borrowing from Lindblom and Urban Morphology

In 2014, the Gozineh Consulting Co. asked the author for technical supervision. They proposed their alternative plan with the incremental process and expressed their pure, innocent practical approach to the proposed process. They wondered if there are any theoretical roots for such an approach. With an urban design background and a pragmatistic point of view, the author relied on the Theorising concept of John Friend (Needham, 2004), seeking a theoretical base for the proposed process. Having a pragmatistic point of view and attitude to urban morphology, the author found common approaches of gradual changes in Lindblom's ideas on disjointed incrementalism, morphological understandings of urban transformation and the incremental approach of the proposed process. Therefore, the author suggested the following steps for an incremental process

and asked to redesign the incremental plan according to these steps (which are presented in Figure 6).

i. Start with a basic sketch plan or just a draft.
ii. In an uncertain context, the first step is to start from something unavoidable. in this project, the land most ready for development were the northern areas due to the enthusiasm of the owner, clear ownership documents, and the highest land stability after the effects of the land erosion resulting from the pit.
iii. Clarifying the vision of the whole plan during the first step of the development.
iv. Seeking more certainty in the context by trying to understand clear boundaries of ownership, expanding the stability of the pit walls and expanding the executable zones, and encouraging further investments.
v. Defining the next steps of design.

Despite this procedural detail, the cohesion of the final form was a problem. To achieve cohesion a basic type is used as a repeating cell in the project. The plan got redesigned based on different variation of the chosen type. It claimed that this type could be a genetic code in the development. Different possible connection rules between the types are generated to handle any connections between development units. Finally, it argued that this process might reorder the traditional linear steps of urban design. In this project, design and implementation are connected. Therefore, designers and contractors face the study, analysis, design and implementation phases together. This process is named the "Incremental Process of Urban Design" (IPUD) to reduce the uncertainties discussed above. When the parameters of the project are less precise, the proposed incremental design process begins early on, with the project's study phase, with an eye on small domains for implementation. As the project progresses and the parameters and limitations become more apparent, the study, data analysis, and design phases are integrated with implementation.

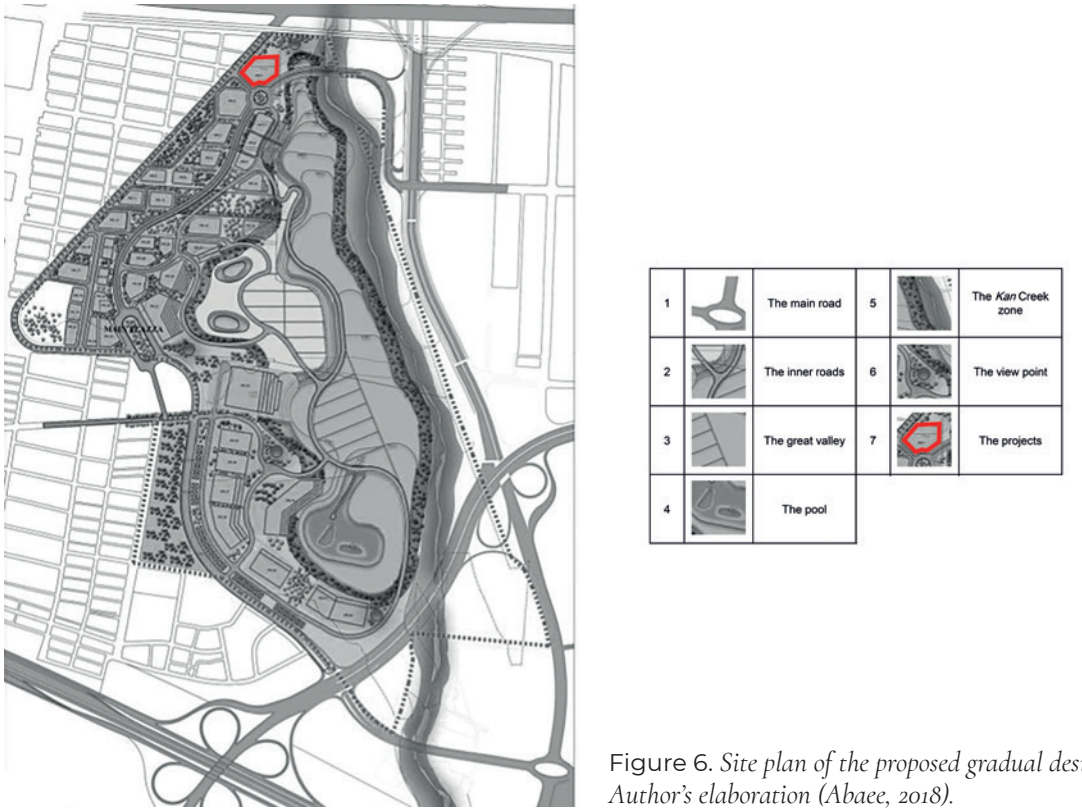

Figure 6. *Site plan of the proposed gradual design. Author's elaboration (Abaee, 2018).*

Conclusion

The implemented idea encourages an extensive study of design processes, large-scale project realisation, studies in project implementations, project management and the role of urban morphology in urban design. The idea of this process begins with an actual project, which may be one of many with the same problem (extensive contextual uncertainties). It is unlikely that the incremental ideas can change the design process as a whole, but they can most certainly contribute to the design of large-scale projects.

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